IRON & COAL

THE IRON AND COAL TRADES' REVIEW

VOL. 162 — LONDON: FRIDAY, [illegible] 23, 1901 — No. 4,340

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SPECIALLY DESIGNED TO UTILISE THE EXTRA STRENGTH IN PREMIUM GRADE BELTINGS

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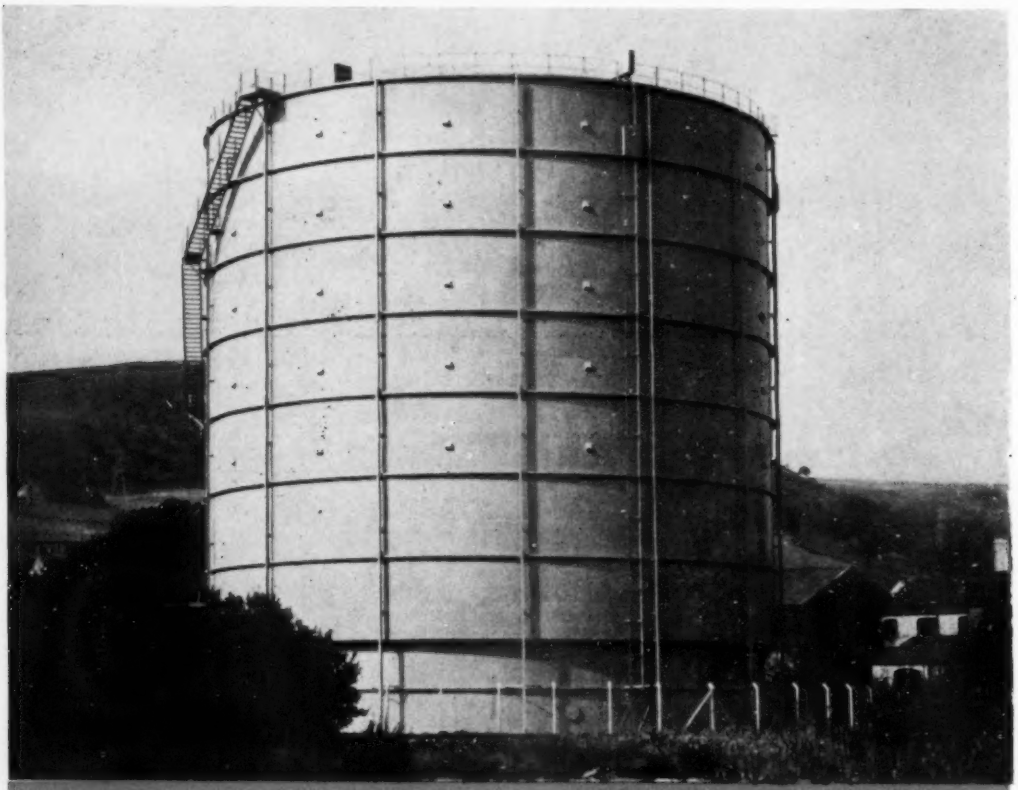

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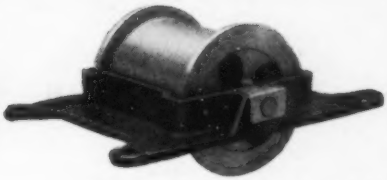
'CY' Multiple Rollers mounted in Malleable Iron Frame



'CY' Rollers to NCB Spec. P110/1954 mounted in Malleable Iron Frame with renewable 'Wynite' bearings. 14 ranges of sizes available, also supplied with Ball or Oilite bearings.

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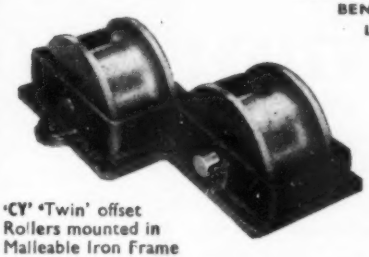
abrasion-resisting alloy outlasts chilled iron by 3-5 times

other applications include **STOWAGE & WASHERY, PIPE BENDS & INSERTS & LINER PLATES**

'CY' Brake Blocks for Shunting or underground Loco's



'CY' 'Twin' offset Rollers mounted in Malleable Iron Frame

'CY' Angle Rollers mounted in Malleable Iron Frame

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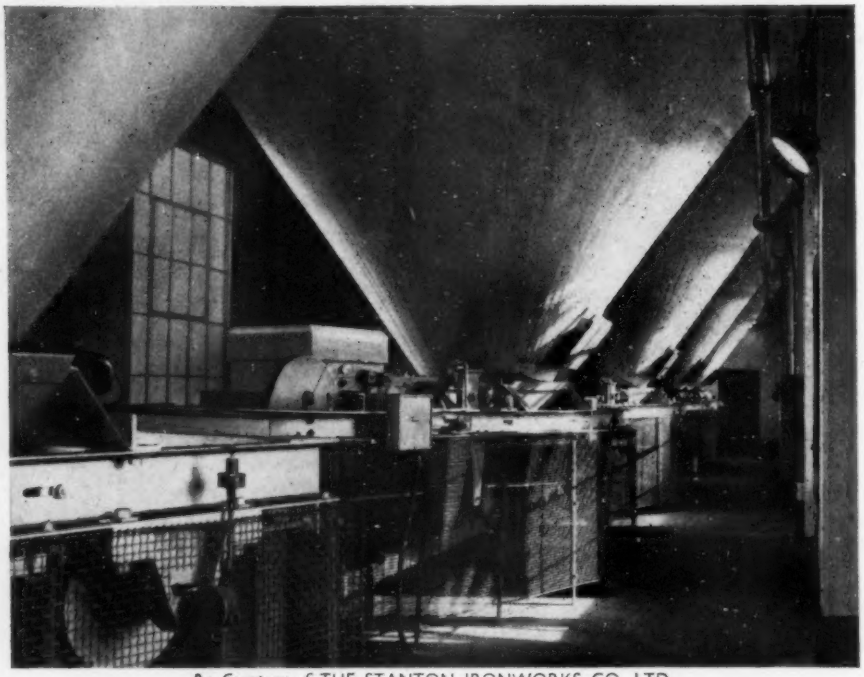
CONTINUOUS FEEDING BY WEIGHT



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". . .'Members of the Jury' I'd begin—and I reckon that would be my lot.

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"A bit like casting a roll when you come to think of it—except for the talking. Always one move in front of the metal, every detail worked out to a hair-breadth and all the time Charlie, the crane driver, is sitting in his box like a blooming judge.

"As for the Jury? Well, I reckon all of us at AW fill that bill, but speeches won't sway us—it's the **result** that counts here."

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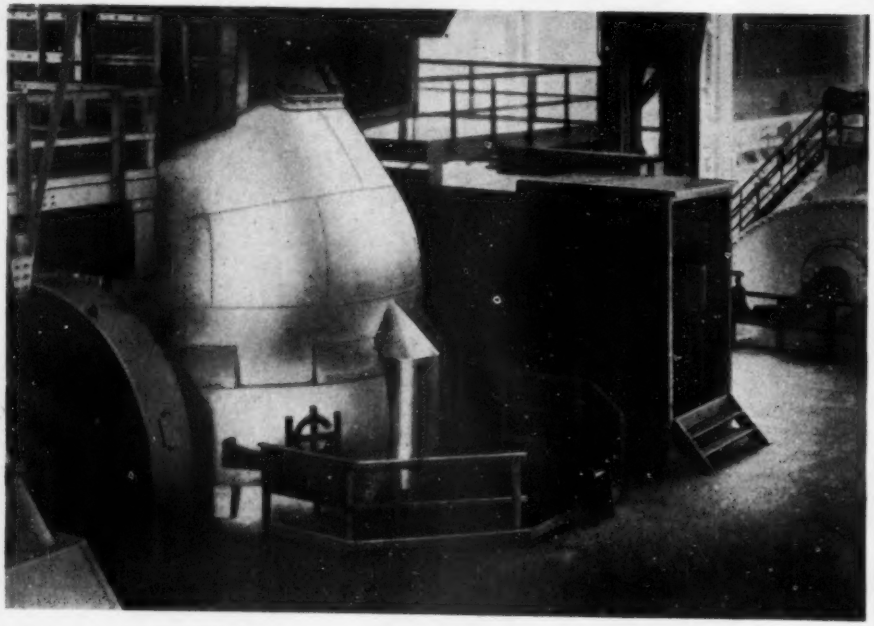

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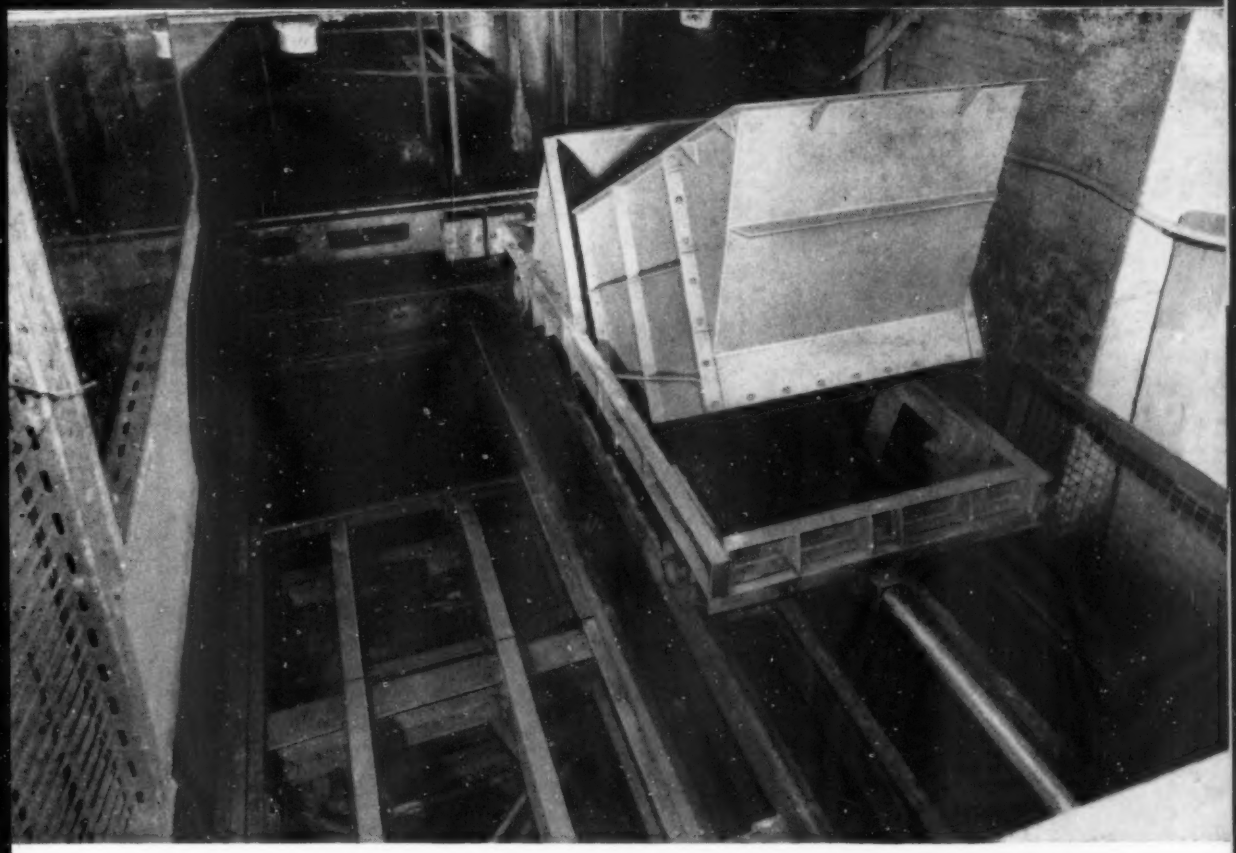
TIPPING CAR SYSTEM of skip loading



A44/B

- Ensures less coal degradation in skip loading
- Means less height for loading equipment
- Now designed with boom loaders to fill tipping cars, so cutting coal degradation still further
- Rapid Skip loading as the loading car tips

PATENT NO. 826,410

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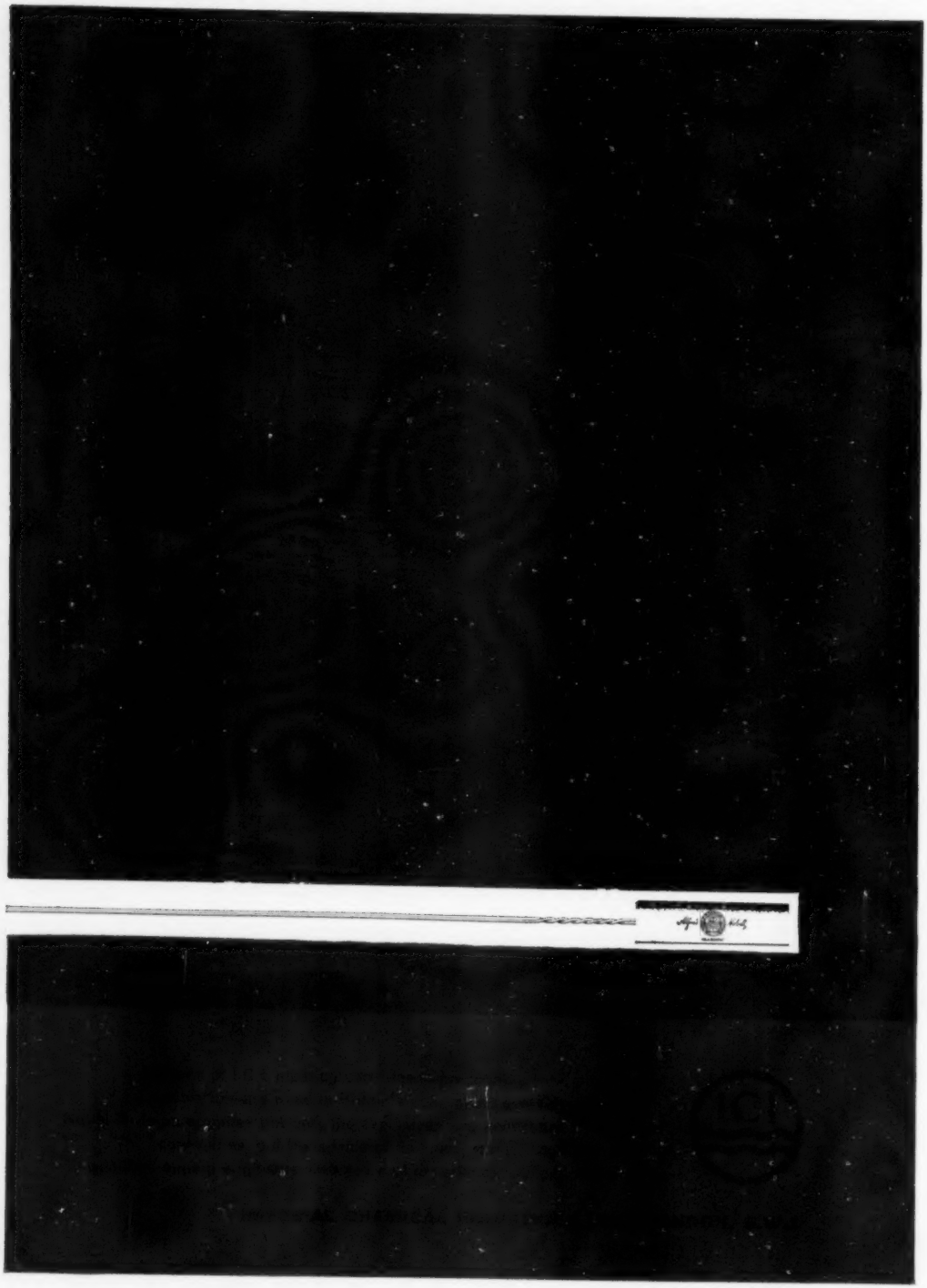
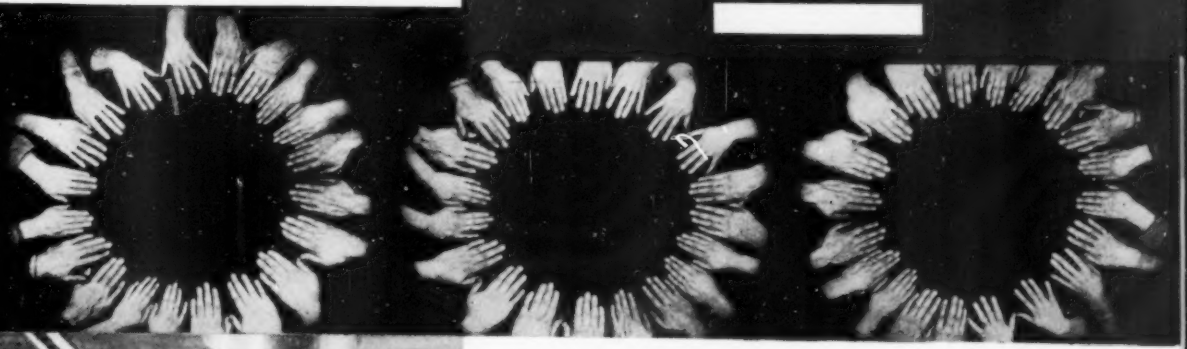
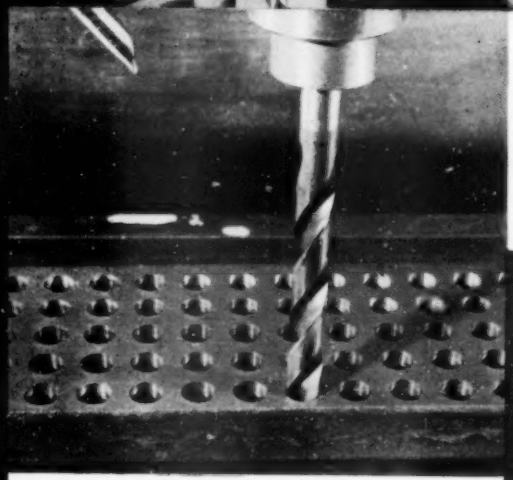


DO YOU K...





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It takes at least thirty people—thirty pairs of skilled hands—to make one DORMER Drill. Every operation is performed by experienced operators with the most up-to-date machinery. Careful heat-treatment and inspection are equally essential in maintaining the consistently high standard of DORMER Tools.

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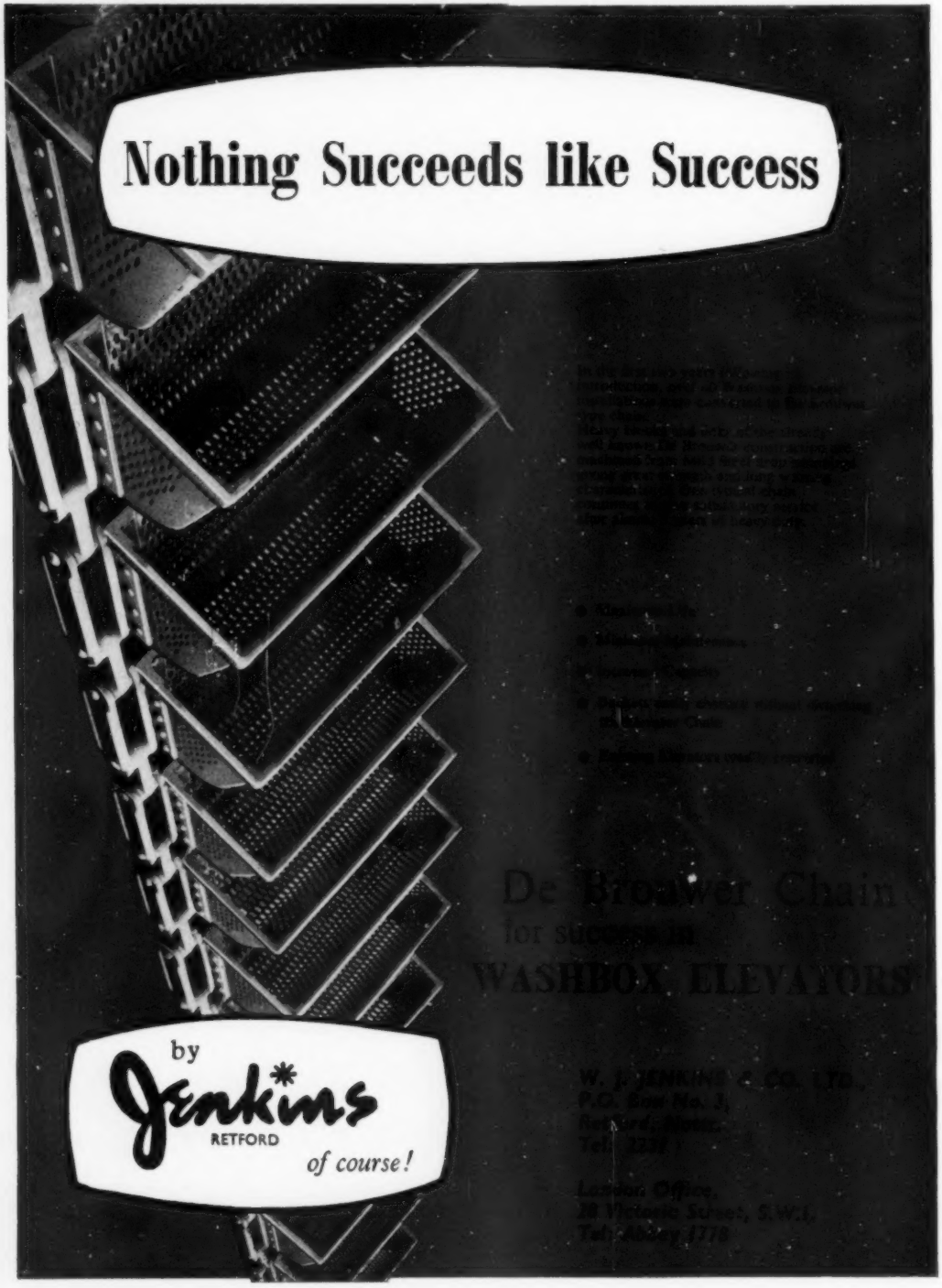
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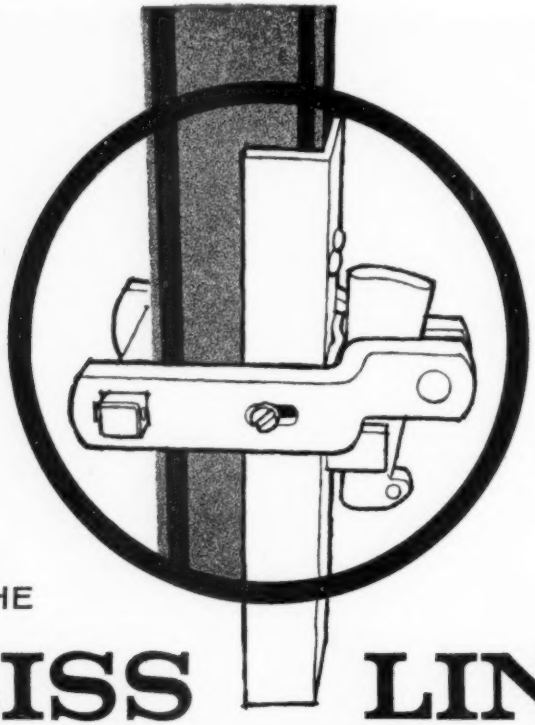

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FOR COLLIERY ARCH SUPPORTS

Specially designed to provide the yielding action essential to colliery arches, as simply and reliably as possible, the Link Stilt is the latest addition to the many Bayliss products giving service to the Mining industry.

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The range covers all standard N.C.B. Arches.

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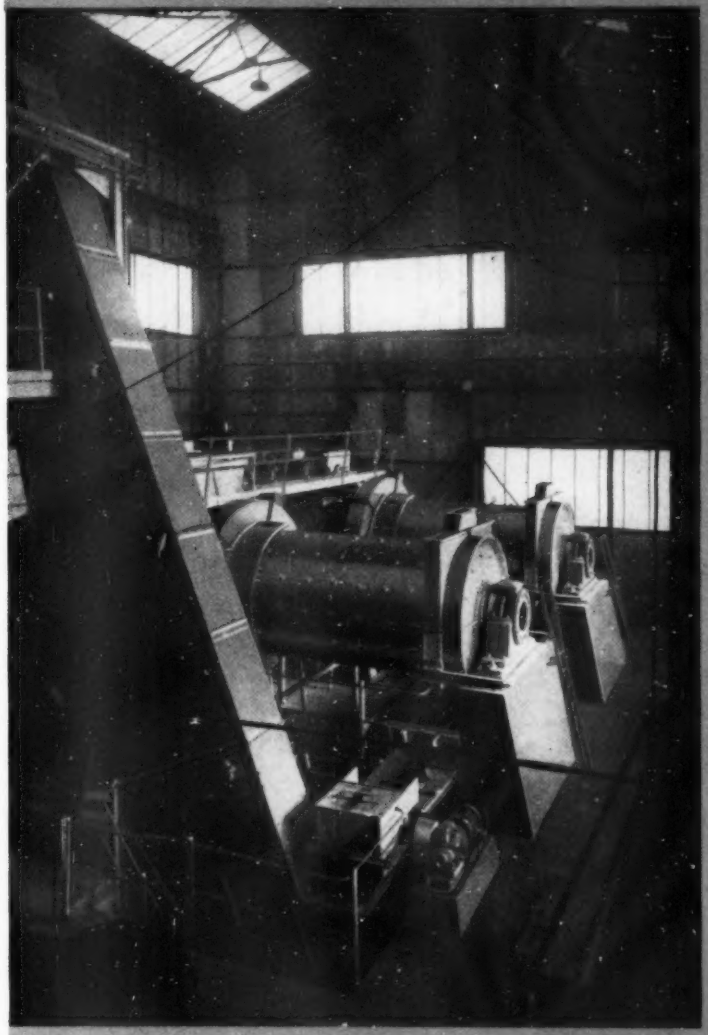

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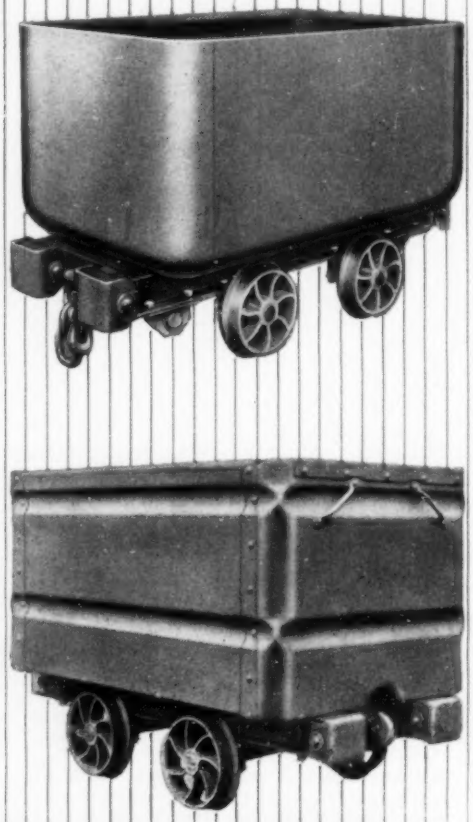

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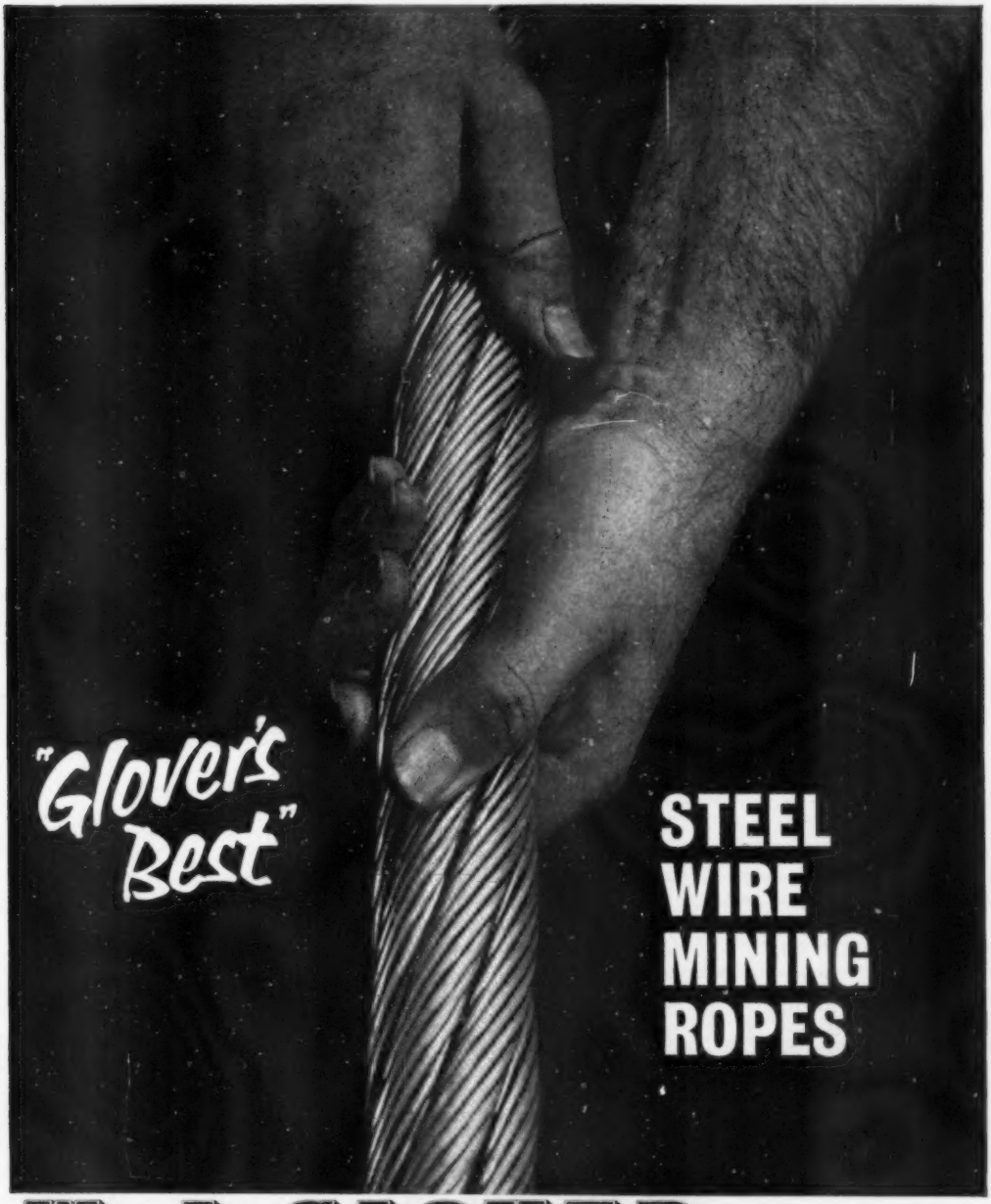

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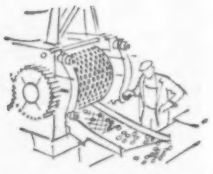

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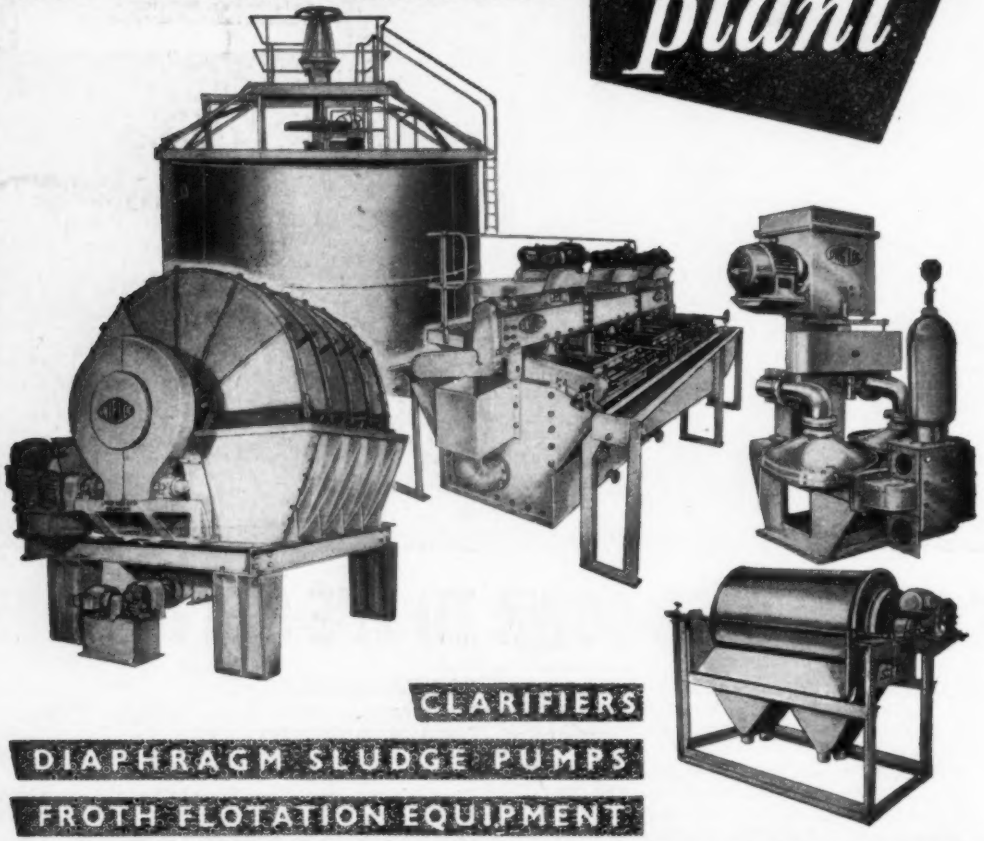

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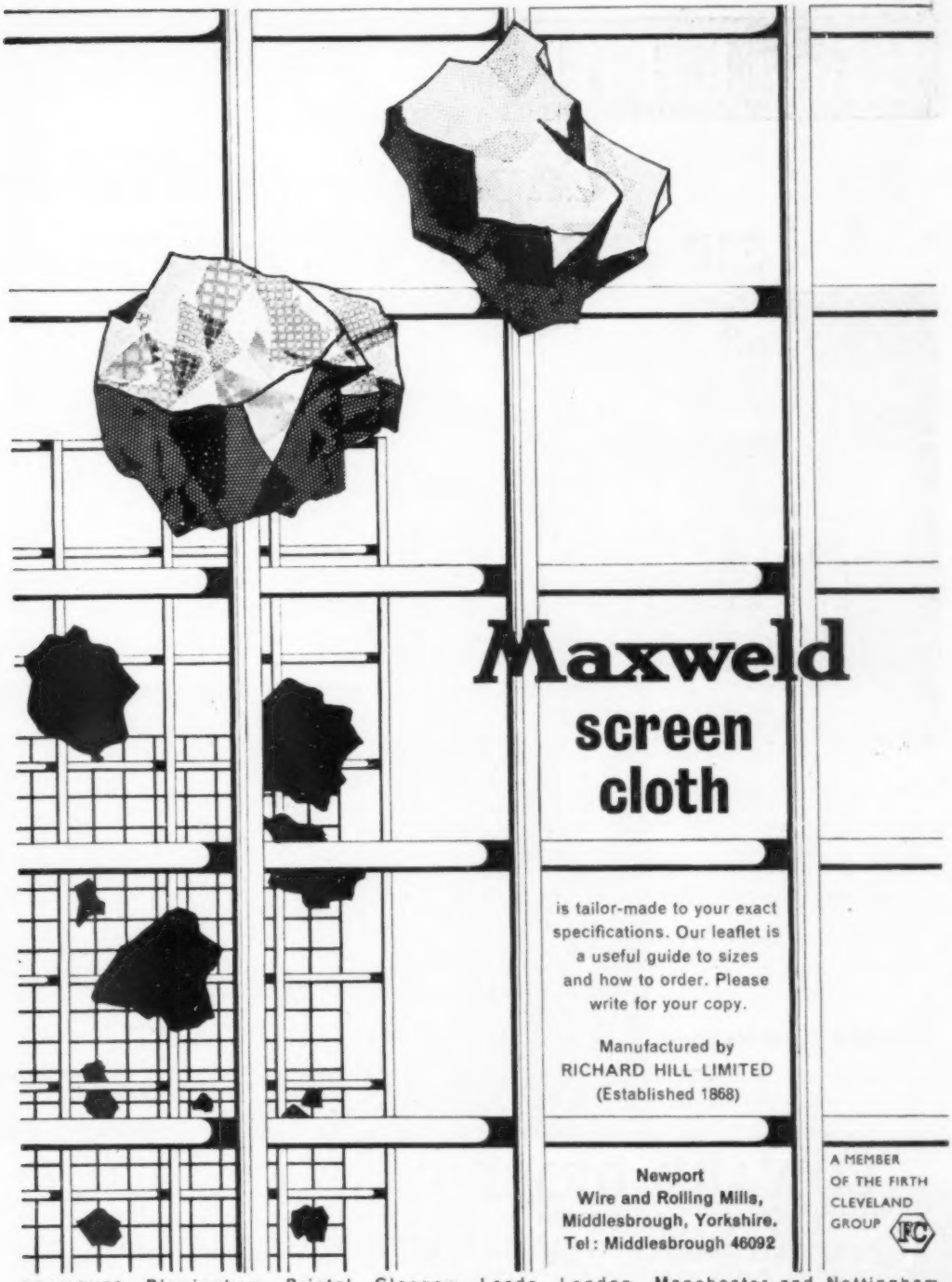

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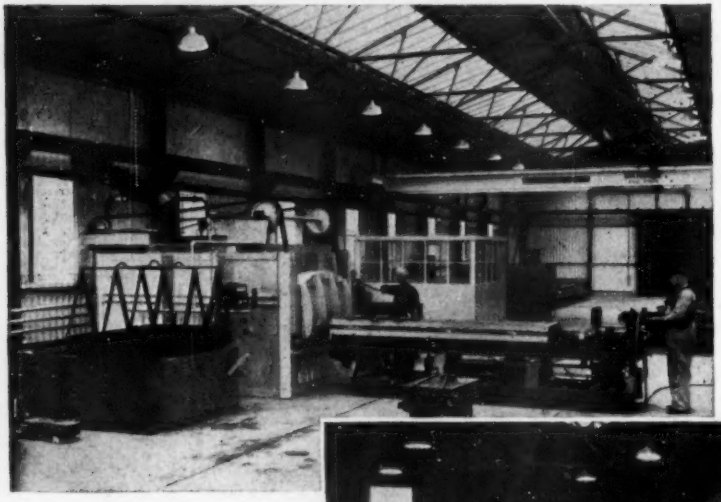

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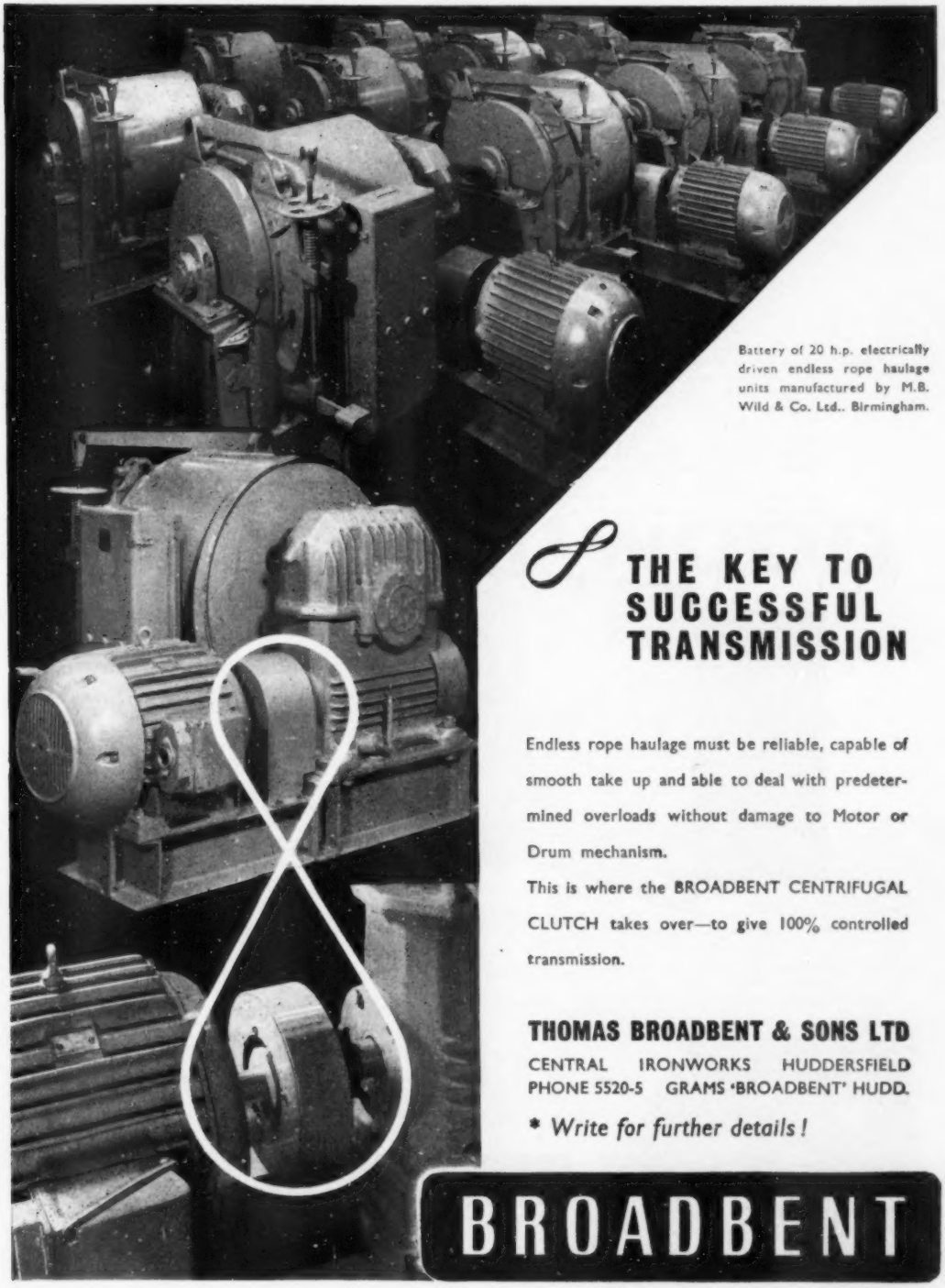

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THE KEY TO SUCCESSFUL TRANSMISSION

Endless rope haulage must be reliable, capable of smooth take up and able to deal with predetermined overloads without damage to Motor or Drum mechanism.

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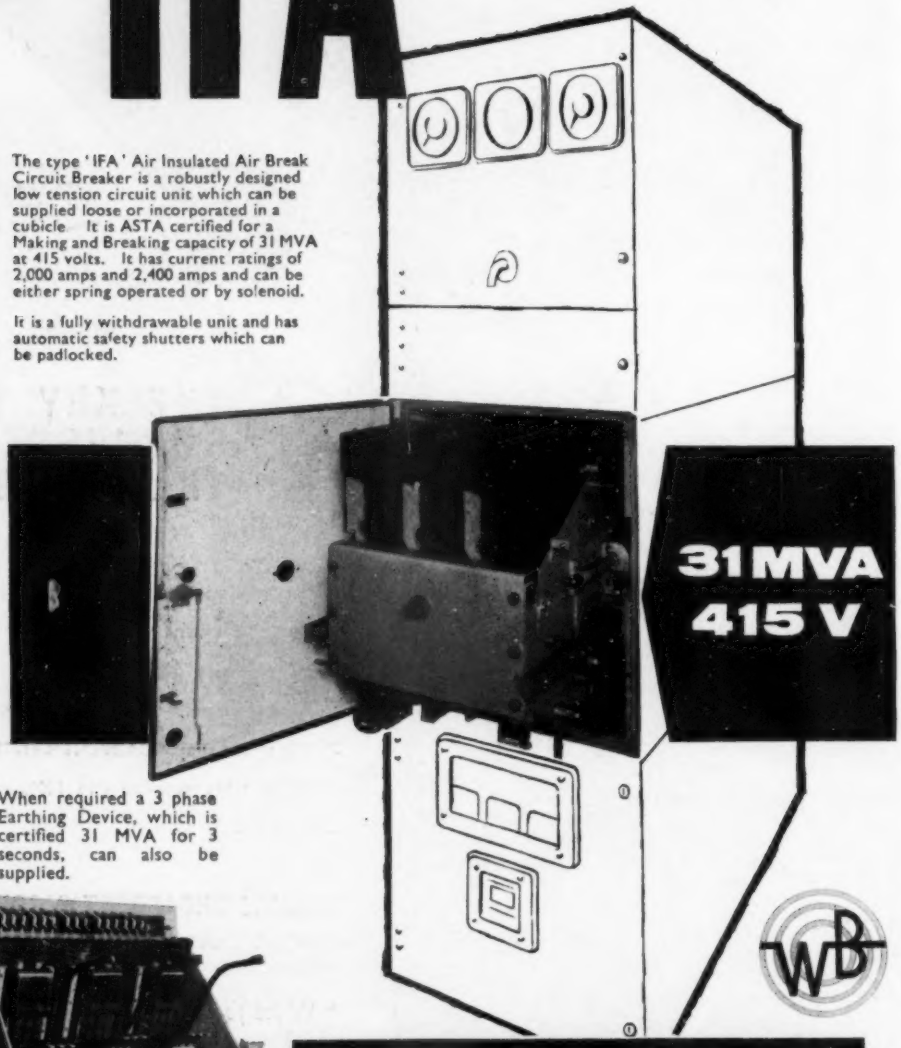
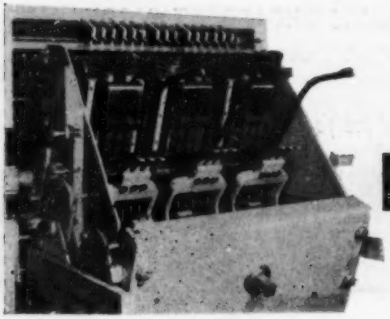
TYPE IFA AIR BREAK SWITCHGEAR

The type 'IFA' Air Insulated Air Break Circuit Breaker is a robustly designed low tension circuit unit which can be supplied loose or incorporated in a cubicle. It is ASTA certified for a Making and Breaking capacity of 31 MVA at 415 volts. It has current ratings of 2,000 amps and 2,400 amps and can be either spring operated or by solenoid.

It is a fully withdrawable unit and has automatic safety shutters which can be padlocked.



When required a 3 phase Earthing Device, which is certified 31 MVA for 3 seconds, can also be supplied.



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High performance
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THE HUWOOD T.C.R. CHOCK

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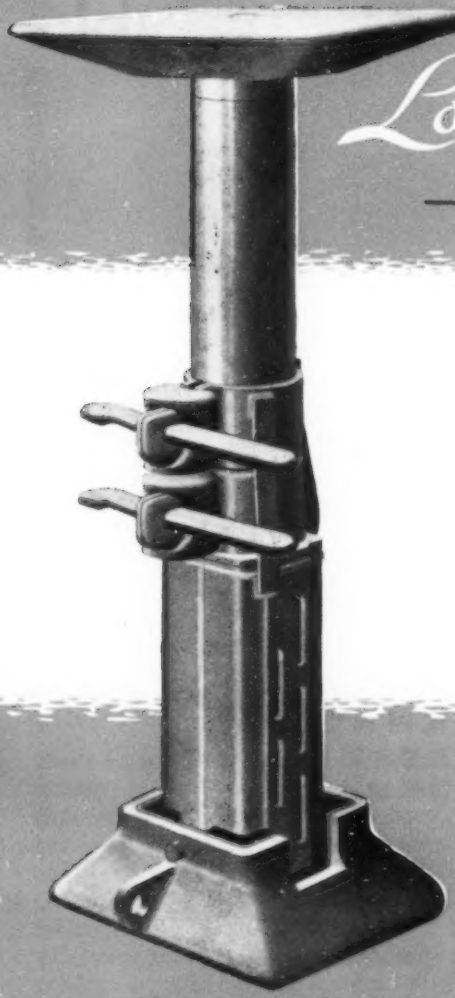

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The design of the Huwood Chock has been streamlined in recent months to give greater ease of handling and improved performance. It is an ideal goaf side support in all face conditions and can be relied upon to function satisfactorily with the minimum of attention. It is a chock every colliery can afford—and few can afford to be without!

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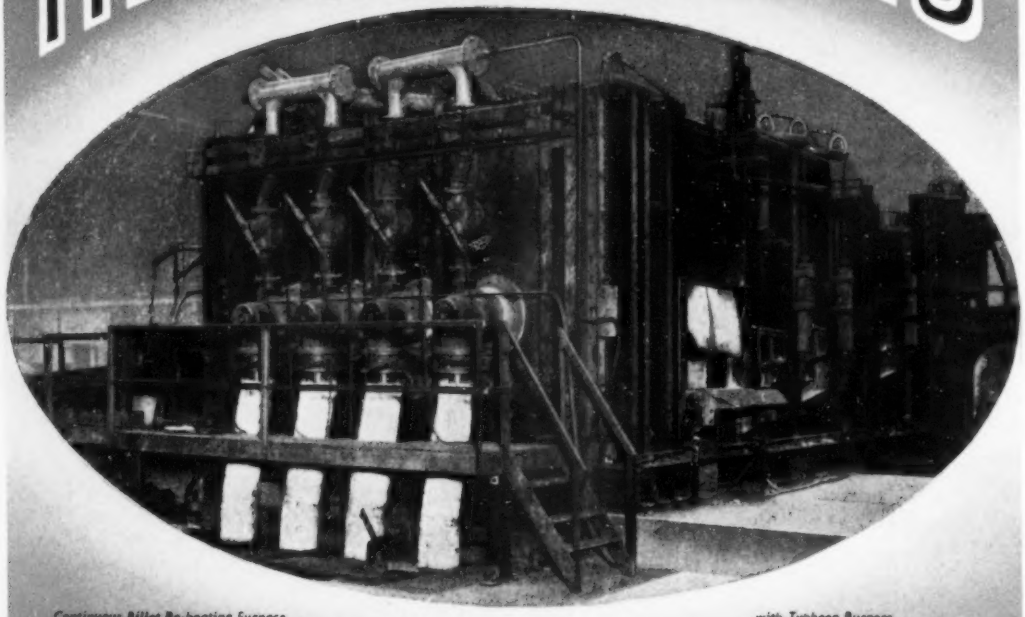

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***Brief specification of the new* JOY MINIVEYOR**

Capacity:	50 tons/hour (coal).
Belt Speed:	175 f.p.m.
Belt Width:	18" (self-troughing).
Motor:	2 h.p. 125v, 50 cycles, with remote control starting.
Drum Centres:	As required—8', 10'4", 13', 15'4", 18', or 20'4".

write now for full technical information.

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DESIGNED TO AVOID STATIC LEAK

The Dobson prop is designed to meet the arduous conditions of modern mining. It is robust in construction, with the minimum of complication in design, giving highly efficient service with low maintenance cost. Its high Yield load resistance of 25 tons gives effective roof support and has the confidence of miners and officials wherever it is used.

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For use in wet conditions or where there is any tendency to rusting, hard chrome plated pressure cylinders (as pioneered by Dobsons) are available at a small extra charge. This treatment has given trouble free service in highly corrosive conditions for over 3 years.

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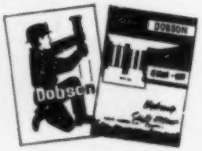
For seam heights 19 to 98 inches.

Yield Load ranges–25, 20 and 10 tons.



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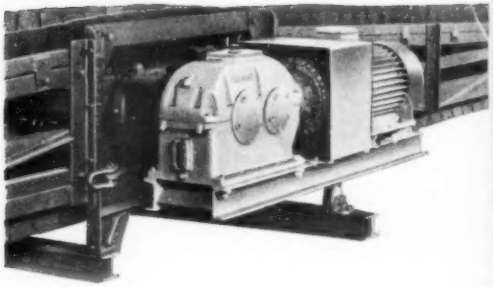
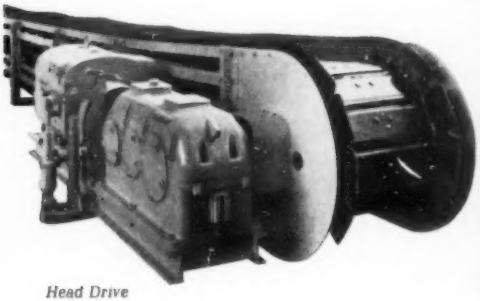
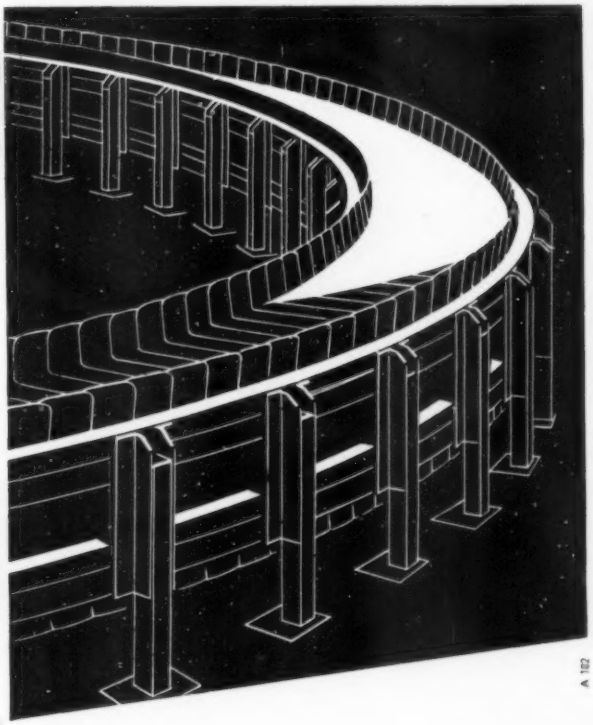


Intermediate Drive



Head Drive



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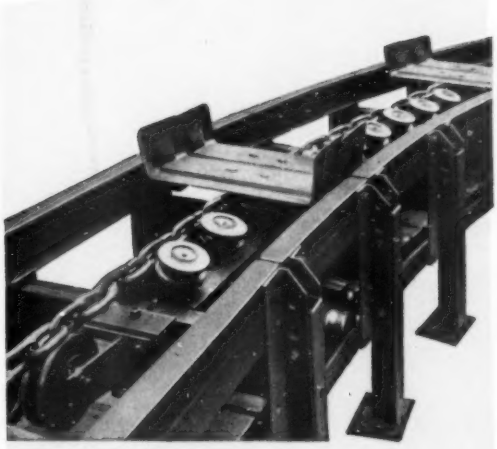

for bends with a 20' radius

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with Round-Link Chains

capable of negotiating bends in road ways with only 20' radius.

Available for widths of 400, 540 and 640 mm.

The Head Drive, Type T, powered by 2 electric motors of 50 HP each is designed for running speeds from 3' to 4'/sec.

By changing the drive sprocket, Type T can also be converted for use with strap-link type chain conveyors.

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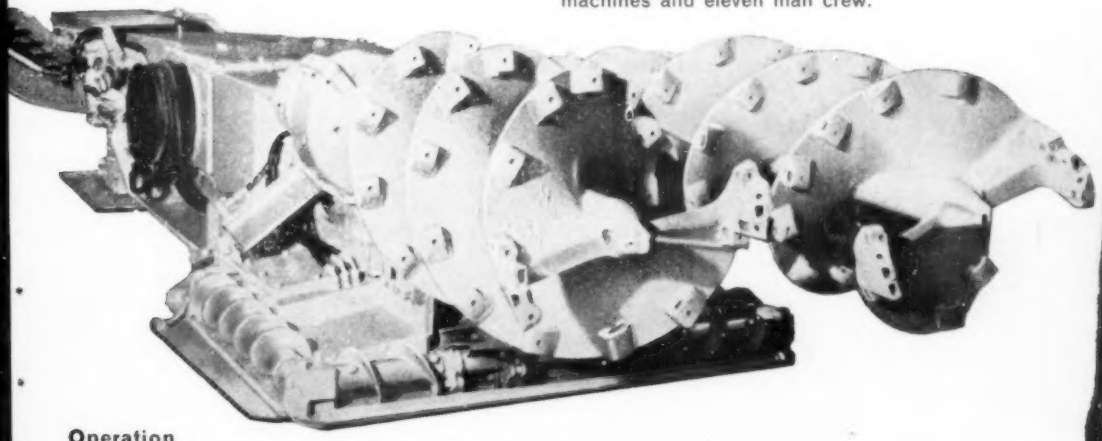
THE **CRAWLEY**-WILCOX CONTINUOUS MINER

Specification

1. Shortwall cutting machine with two augers, the diameters of which can be varied according to seam thickness.
2. Tungsten carbide cutting picks on front cutting edges and auger scrolls.
3. Flameproofed to British Standards.

Performance

1. Seams 22 in. to 46 in.
2. 300 tons per shift in 36 in. seam with two machines and eleven man crew.



Operation

1. Motor driven augers through reduction gearing rotating in opposite directions—forward oscillation prevents coal binding.
2. Hydraulic controls on machine and conveyor.
3. Coal discharges on to bridge conveyor and thence on to chain conveyor.
4. Bridge conveyor pivots at either end.

Appreciation

1. The lowest Continuous Miner on the market in height, cost and maintenance.
2. Operating in conditions where other equipment has failed.

All Crawley Heavy Duty Machines have the following units standard and interchangeable:

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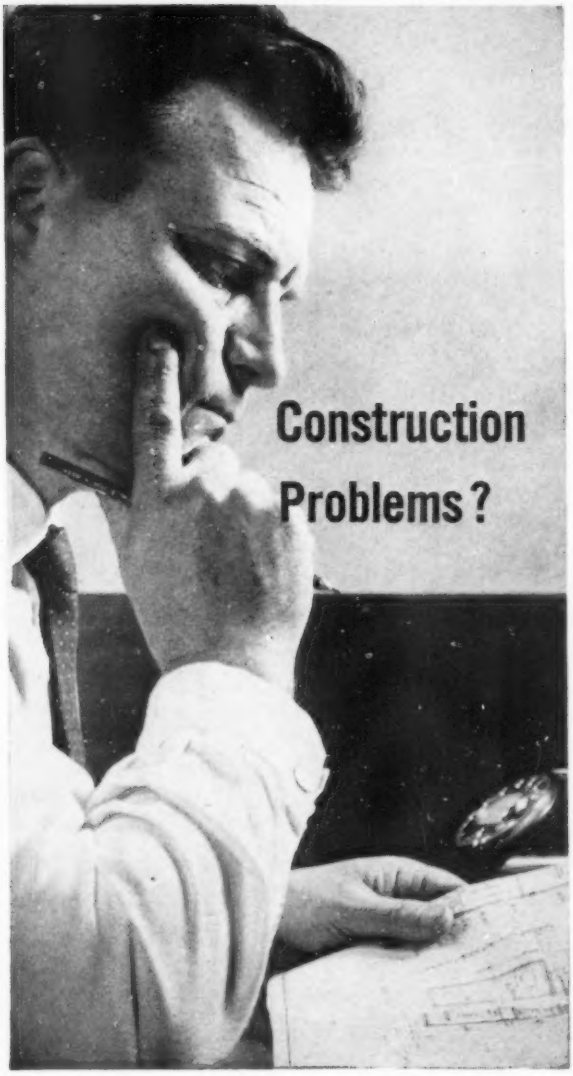

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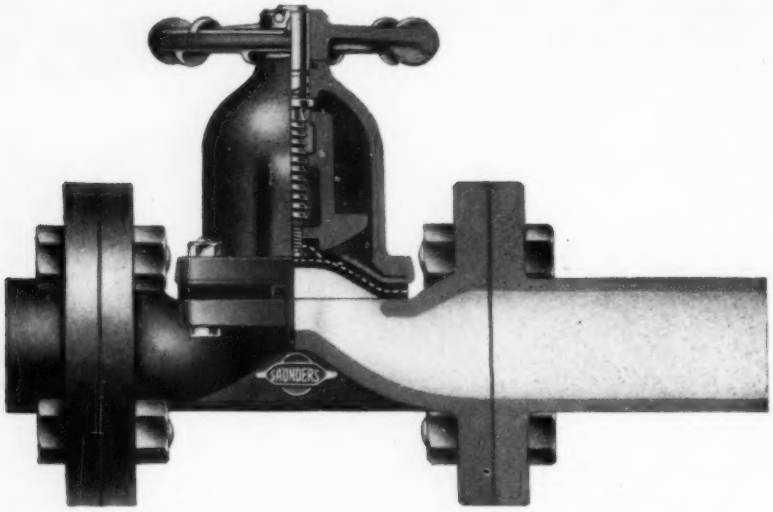

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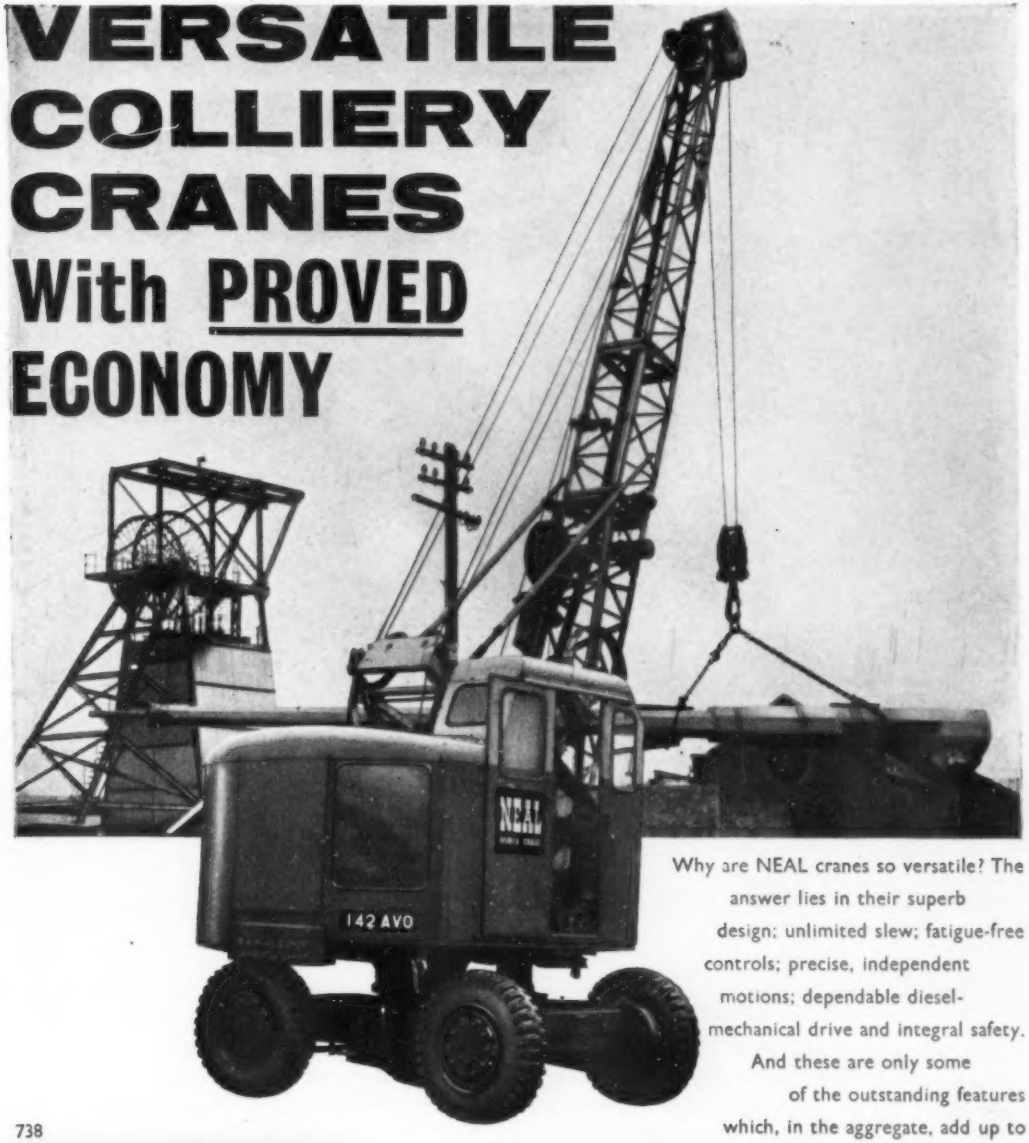

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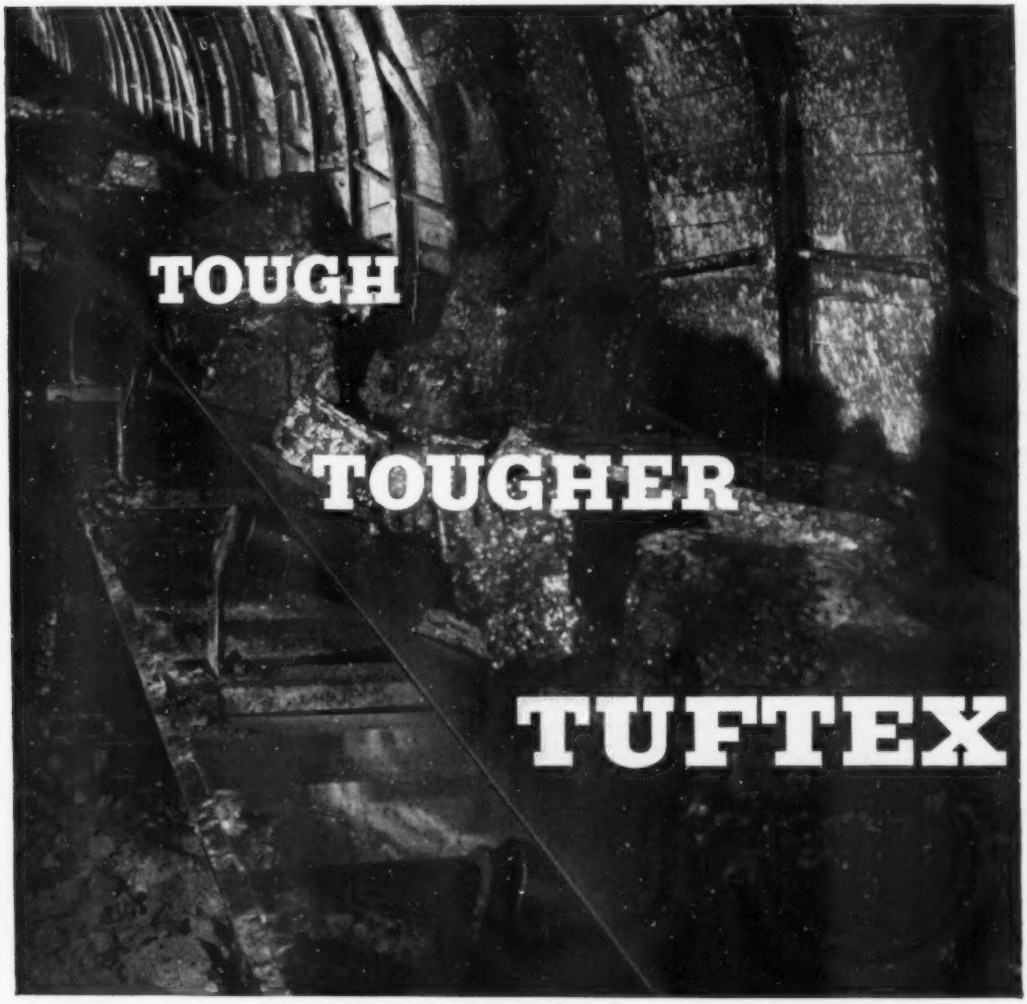

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Above—*TUFTEX belting in service at Highley Colliery on the conveyor which handles the whole of the pit's output (photograph by courtesy of the National Coal Board, West Midlands Division).*

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BLAST HOLE DRILLING
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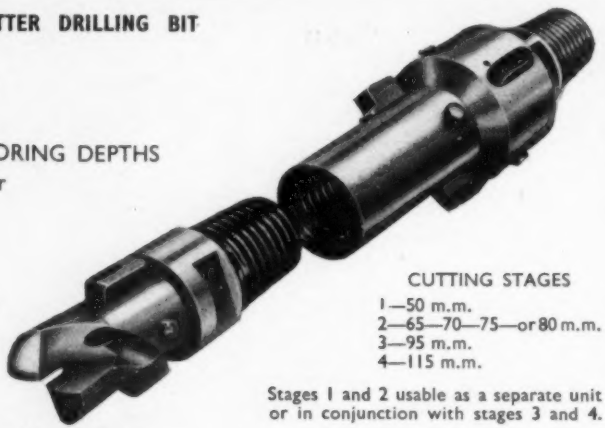
Equally suitable for Air or Water Flush

Reconditioning on site—change of cutters is simple.



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4—115 m.m.

Stages 1 and 2 usable as a separate unit or in conjunction with stages 3 and 4.

Screwed to suit various standard Rods.

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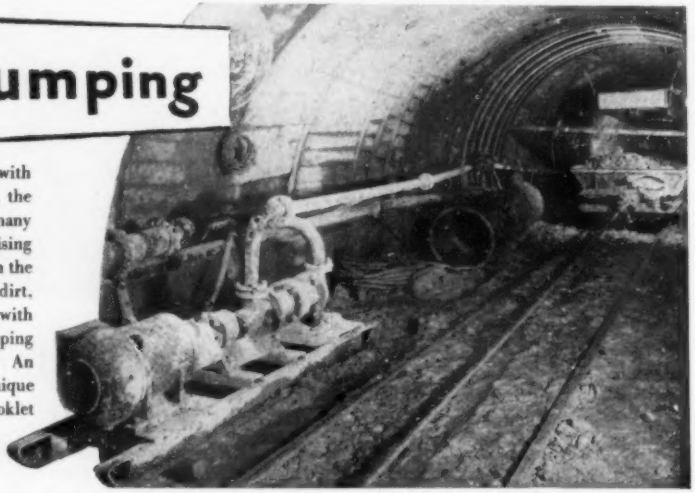

The MONO pump

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at the Abbey Works of

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Initial installation — 20 Pits

Repeat orders have been received increasing this installation to 38 Pits — the largest battery of Soaking Pits in Europe.

The Soaking Pits illustrated above incorporate Gas Mixing Stations, complete automatic control of temperature, combustion and pit pressures. Gas and Air supply are automatically cut off on removal of Covers.
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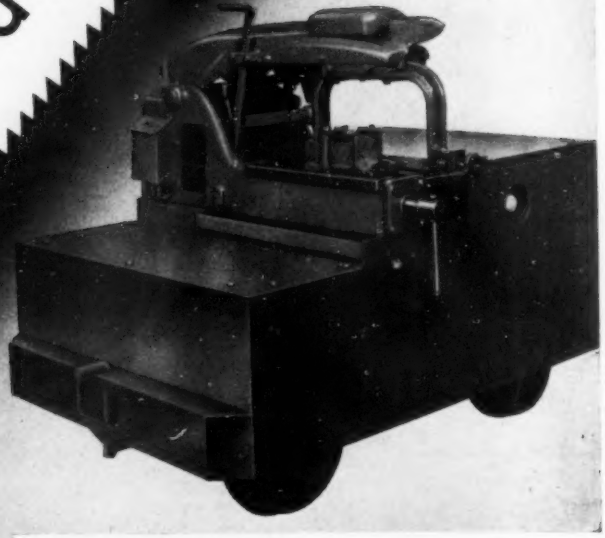
underground saw unit



A mobile unit powered by compressed air or electric motor for sawing steel underground with safety and speed.

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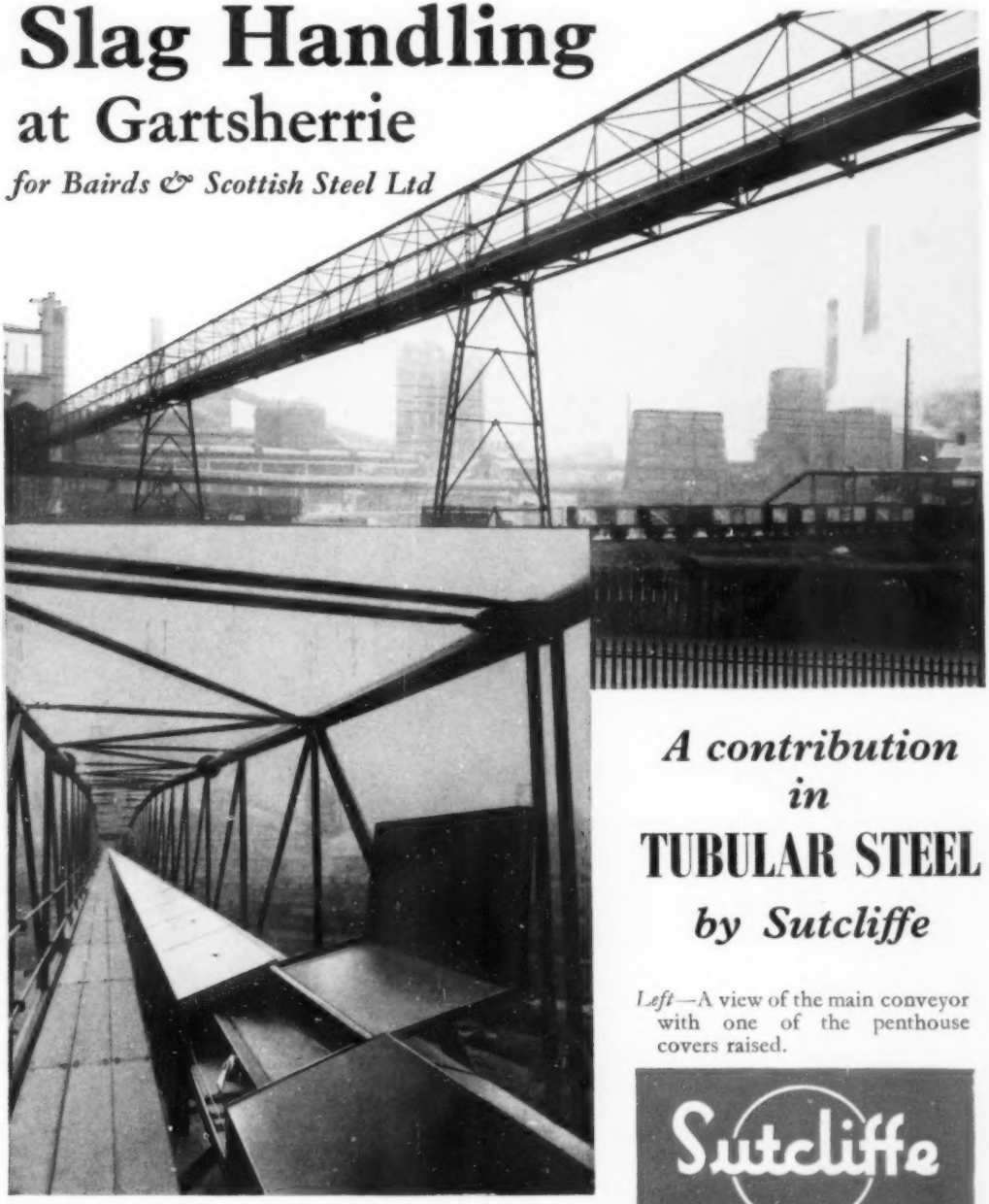

A contribution in
TUBULAR STEEL
by Sutcliffe

Left—A view of the main conveyor with one of the penthouse covers raised.

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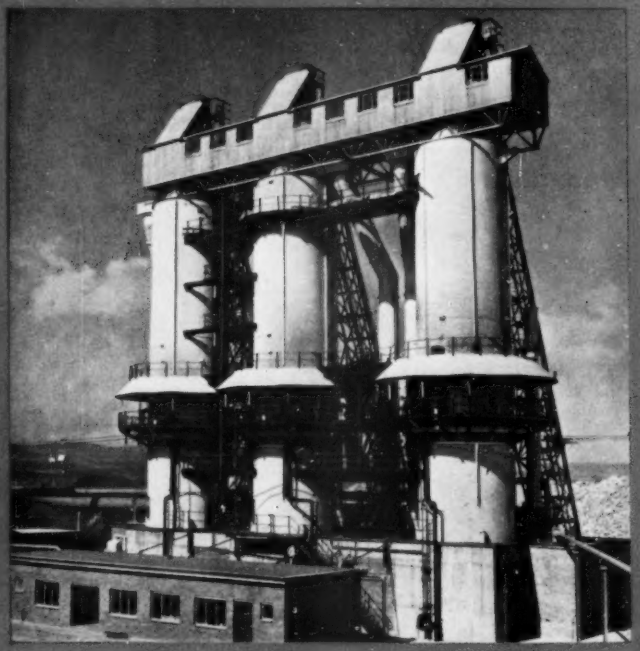

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Advantages?
Greater flexibility of output, less coal degradation and increased production.

Requires only one man to operate.

Developed in conjunction with the Mechanization Dept. of Area 1 East Midlands Division of the National Coal Board.

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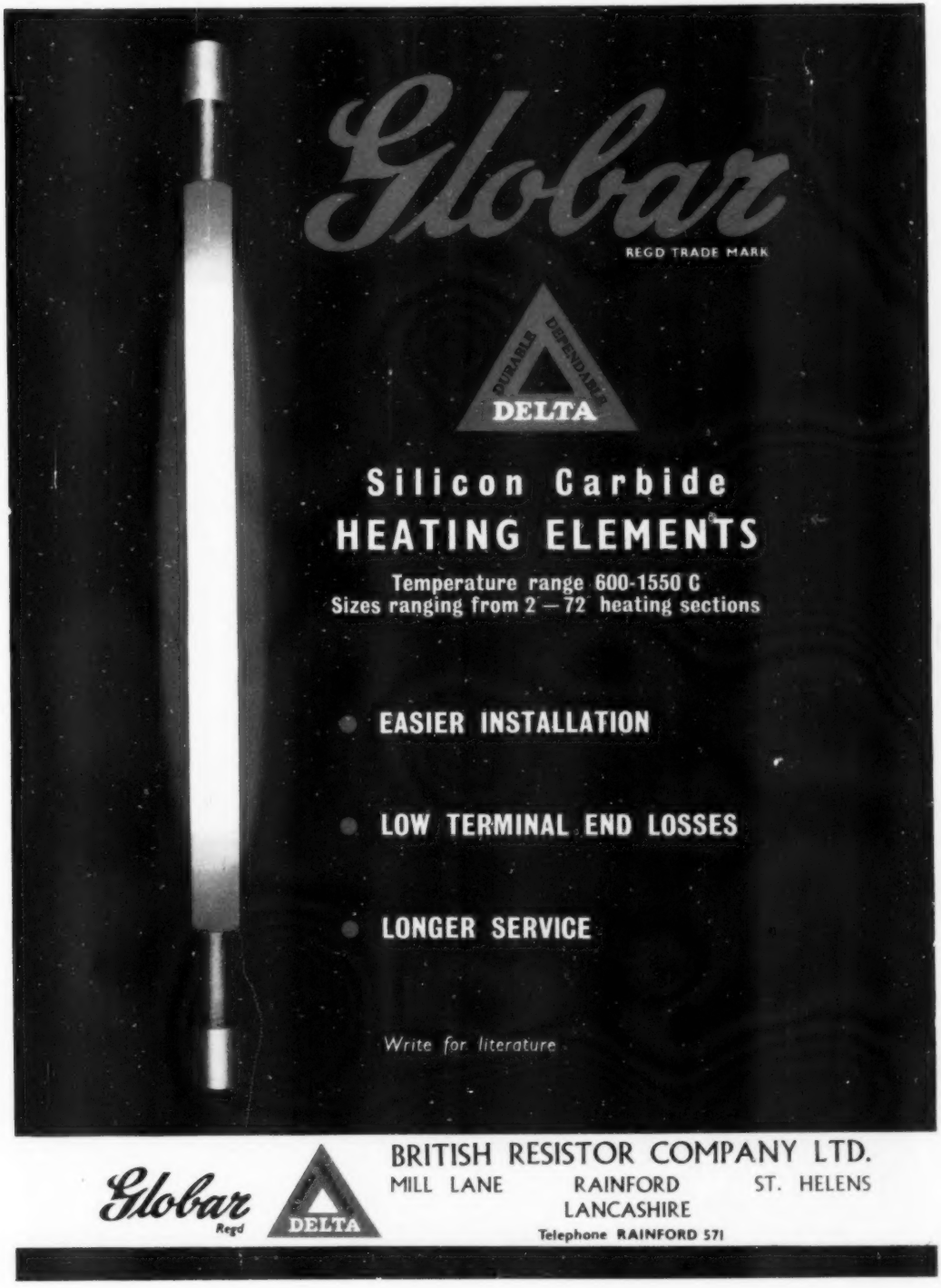
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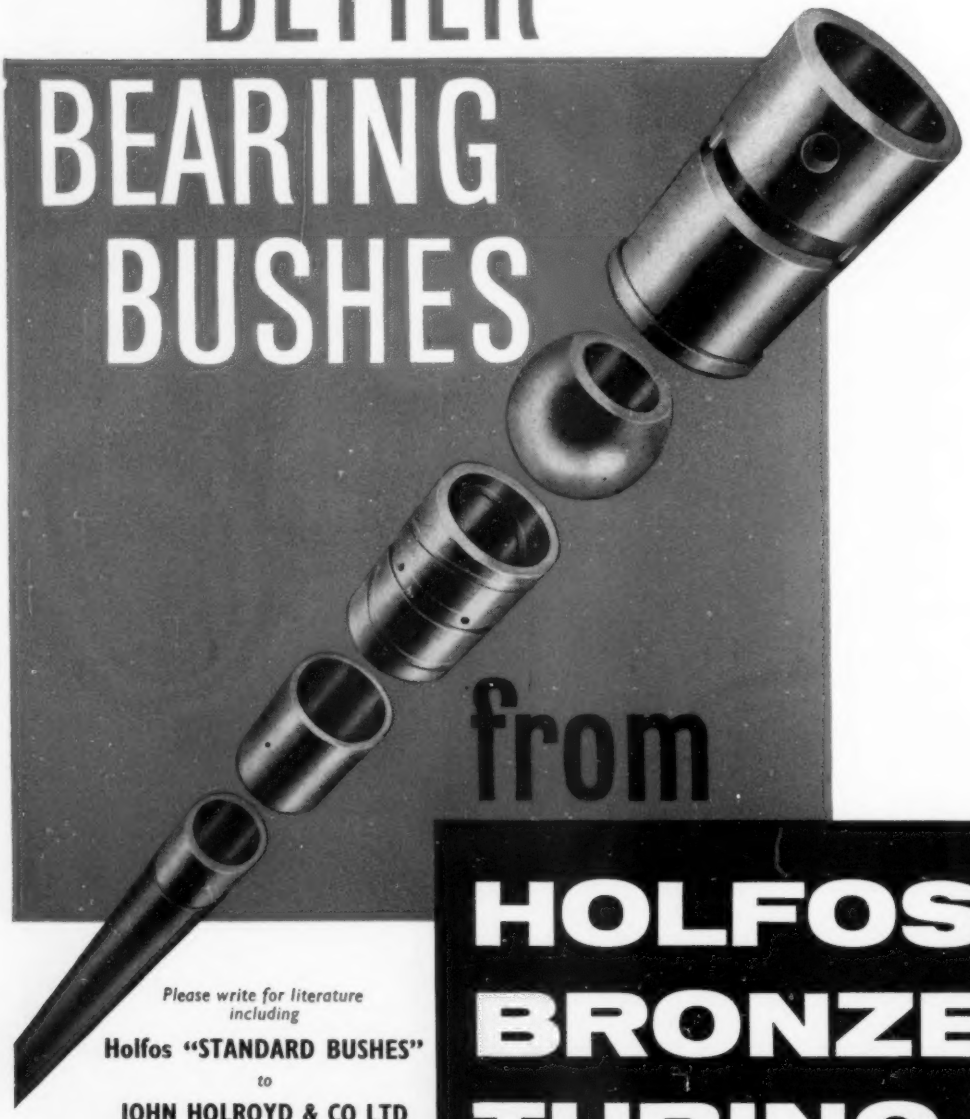

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The colliery manager must take the rough with the smooth and maintain a consistent output of coal even when the conditions are unfavourable. He needs well tried and versatile equipment to help him in his arduous task. The Cowlishaw Walker Butt Joint Conveyor, invented in 1949, made possible the present day widespread use of the chain conveyor at the coal face in Britain. Its simplicity, ease of handling and absolute reliability under wet and adverse conditions have provided a standard of dependability which has been maintained year after year.

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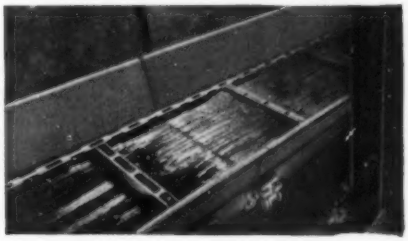
BUTT JOINT CHAIN CONVEYOR

The conveyor which overcomes difficulties in its stride.

★ The new C. W. Butt Joint Pan is universal in its application.

★ On the face and in the gate for longwall working, in the rooms and in the entries for bord and pillar working.



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is totally enclosed, rigid and compact.

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are robust and particularly easy to handle and they give complete protection to the return chain.

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of high precision construction has considerable advantages over the single strand types:

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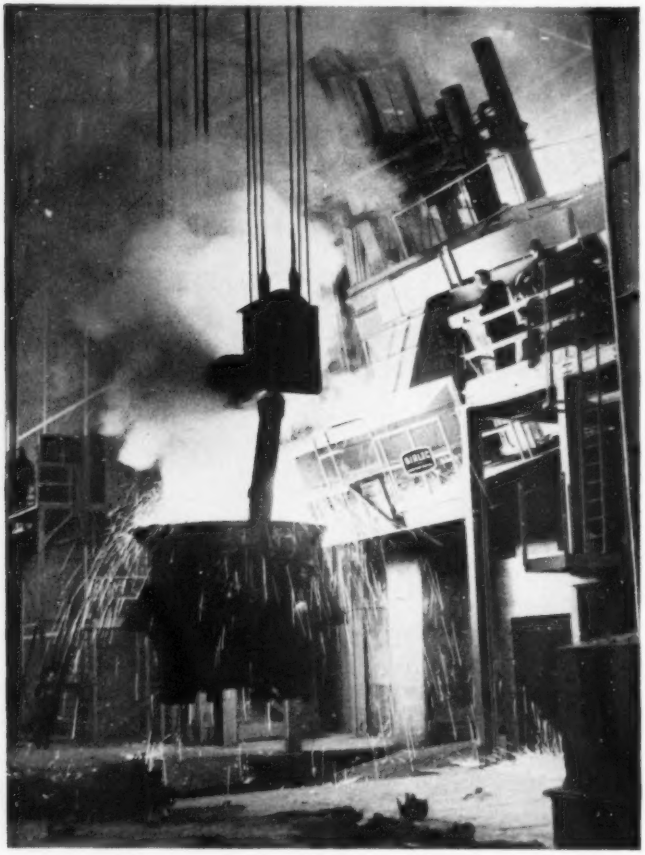

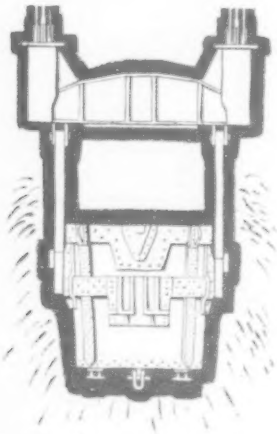

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Editor:
F. H. HARLEY

Assistant Editor:
P. E. CARDEN

Metallurgical Editor:
C. W. J. CRAWFORD, A.I.M.

Mining Editor:
H. COOPER, A.M.I.MIN.E.

News Editor:
R. M. HOWSE

Associate Editors:
J. J. CALEY and B. M. DAVEY

District Representatives:

E. G. COLLIS (Southern) Tel.: TRAfalgar 6171

A. D. H. CURRIE (Northern) Tel.: Ringway 2452

E. J. SWEETING (Midlands) Tel.: Plumtree 2585

T. H. SMITH (Scotland and N.-E. England) Tel.: Dumbarton 1046

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R. J. LOVELL

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H. J. DWYER

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In this Issue—

DEVELOPMENT IN SOVIET STEELWORKS
Air-cooled Stopper for Teeming Steel - - - page 1331

THE MIDGET MINER
Trials in the Garw Seam - - - - - page 1335

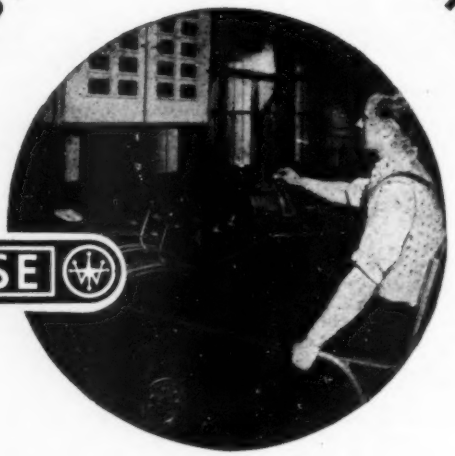
CONSTRUCTION EQUIPMENT EXHIBITION
Big Display at Crystal Palace - - - - page 1345

SAFETY IN COAL MINES
Northumberland and Cumberland Division - - page 1347

THE OPEN-HEARTH PROCESS
Some Alternatives Considered - - - - page 1351

	PAGE
Leading Article: Dearer Steel	1321
Record Run by Blast Furnace at Millom Hematite	1322
Passing Thoughts	1322
Steel Prices Increased	1323
Lodge-Cottrell Contracts for Precipitators	1323
Personal	1324
Exporting to Germany	1325
Law Cases	1326
More Welsh Coal Needed to Retain Markets	1326
Mr. J. C. George at NCB Central Engineering Establishment	1326
Plain Statement	1327
Foundations Are Completed at Spencer Steelworks	1328
Revival by Industry	1329
East German Order for UK Rolling Mill Equipment	1329
Industry's Capital Spending on the Increase	1329
Orders Placed	1330
Greater Demand for Coal in UK and ECSC	1330
Heat Transfer Between Metals in Contact	1334
Stora Kaldo Steelmaking in the US	1334
Anthracite Preparation Process	1343
Pig-iron and Steel Production	1344
Roof Bolt Modifications	1348
Dewatering Froth-flotation Tailings	1348
New Indian Coal Mines	1348
New Literature	1349
Plough for Armoured Flexible Conveyor	1350
Automatic Surface Handling of Coal	1350
Forthcoming Events	1350
Vacuum Casting	1361
New German Steel Plant	1361
Britain Third Largest Steel Producer in Europe	1361
Alfred Herbert Research Centre Opened	1362
Appointments	1362
New President of Institution of Production Engineers	1362
In Parliament	1363
Board Changes	1364
European Coal Output	1364
Steel Stocks Rise	1365
Western Australia Seeks Industrial Development	1365
Production Plans for New Ghent Steel Unit	1365
Better Steel Supply for Ambrose Shardlow	1365
The Scrap Markets	1366
Sanderson Kayser Plant Replacement Plans	1366
Iron and Steel Trade	1367
Ore Chartering	1367
Coalfield News	1368
Co-ordinated Policy for Fuel "Desperate"	1368
The Coal Trade	1369
Coal Output and Stocks	1369
Obituary	1370
Another Successful Year for Worthington-Simpson	1370
Recent Wills	1370
Company News	1371
£3,000,000 Mining Equipment Order from Costa Rica	1372
News in Brief	1374

MODERN MINE CAR HANDLING



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IRON & COAL
THE IRON AND COAL TRADES REVIEW

Vol. 182 June 23, 1961 No. 4,849

Dearer Steel

THE justification for this week's increase in iron and steel prices is to be found in the rising costs of production. It was the failure to keep costs on an even keel that caused the rise in coal prices last year, and exactly the same reason was advanced by the chairman of British Railways when he spoke recently of the need to raise fares and possibly freight charges. The trouble is that all goods and manufactures are somebody else's raw materials, and any increase in price tends to have a snowball effect which perhaps can be borne along the line, but is disproportionately felt when it comes to the end product. In the present state of the national economy the fundamental need is to increase exports to pay for imports, and when we finally arrive at the finished product the consumer abroad will do what consumers everywhere do if they regard prices as too high—cut his purchases or go somewhere else for his supplies.

The fact that the steel price increase can be fully justified does not make it any more palatable to consumers. The National Coal Board had facts and figures galore to justify the increase in coal prices, but that did not stop steelmakers and other consumers grumbling about it. There, however, the comparison ends. Whereas coal prices had gone up steadily since 1939, the iron and steel producers reduced their prices in March, 1958, cut them further in June, 1959, and lowered them yet again in February, 1960. By scrapping old plant and adopting new ideas the steelmakers improved their productivity—and passed some of the saving in costs on to the consumers. It would have been a bit unfair, even to the point of ingratitude, to have refused them some increase now in view of the extent to which their costs have risen in recent months.

The increase in fact is only 1 per cent., whereas the steelmakers wanted at least twice as much. One senses that the Iron and Steel Board is slightly apologetic about the smallness of the increase. Having stated that it regards as of particular importance "that producers should achieve the greatest possible cost savings through higher efficiencies," the board goes on to say that it recognizes that the industry has had to face substantial cost increases in recent months, and that some price increase is warranted, "its extent being necessarily a matter of broad judgment."

The British Iron and Steel Federation reckons the increase in the industry's earnings as a result of the higher prices at a rate of £7,500,000 a year over the second half of 1961. Over the same period, additional costs are estimated at a rate of about £25,000,000 a year net, after taking into account all expected savings from greater efficiencies. The federation considers the increase now given "to be totally inadequate having regard to the recent additional cost burdens on the industry."

The steel markets are at present going through a hesitant period, and there is no doubt that the mills would much prefer to have reduced prices, or at least left them where they were, than have increased them at this stage. The inexorable logic of their cost figures drove them to ask for an increase, which has been granted belatedly and a little parsimoniously. Big steel consumers have nevertheless not been slow to complain. The British shipbuilding industry views the increase "with grave concern," and says it will handicap builders in meeting fierce competition for the limited number of new contracts now offering and hit firms which have managed to secure new orders recently "at fixed and very keen prices."

We learn once again that one basic industry cannot merely by a price movement improve its position without impairing the position of another basic industry and also affecting the fortunes of consuming industries. Coal goes up in price and steel willy-nilly follows suit. Steelmakers are denied the benefit of cheap foreign coal; the mines pay more for their steel requirements and see their own costs move up again. The steelmakers see their costs going up and their profits going down—profits that they must make if they are to attract the public money they need to finance the new plant they must have if they are to survive as an industry in a world of steelmakers. At the same time they suffer a falling back of orders which may, for all they know, be accentuated by the increase in steel prices they have obtained, meagre though it is.

It is the vicious movement—call it circle, spiral, snowballing, or what you will—that economists have talked about *ad nauseum* for generations, but which is still a most potent force in shaping our industrial and economic destiny. To start such a movement is a heavy responsibility, and one can forgive the Iron and Steel Board for not wanting to give more than the smallest turn to the wheel that is steel. All told, steel consumers can count themselves fortunate, at the expense of the steelmakers. Similar forbearance on their part, in absorbing themselves as much as possible

of the increase in their costs of production which will result from dearer steel, will be of prime benefit to the country in the present state of its economy. We just cannot afford at this stage an upward movement in export prices, whether it is started by raw material costs or by labour charges. And somehow we must avoid placing any further burden on manufacturers. Even the hint of higher transport rates is frightening in the extreme.

Record Run by Blast Furnace at Millom Hematite

RECORD run has recently been completed by the No. 3 blast furnace at the Millom Hematite Ore & Iron Company, Limited, Millom, Cumberland. The furnace was blown in on April 11, 1953, and blown out on April 28, 1961, during which time the furnace consumed 1,616,670 tons of ore, 269,000 tons of other materials, and 822,046 tons of coke. This resulted in a total iron make of 1,013,474 tons at an average coke rate, for the full campaign of 16.23 cwt. per ton of iron.

For the last two and a half years of the campaign the furnace worked on as near a self-fluxing mixture of sinter and ores as could be managed and in this period the coke consumption dropped to under 13.00 cwt. per ton of iron. During this period for quite a number of weeks the furnace was operated on practically 100 per cent. self-fluxing sinter on a blast temperature of over 1,000 deg. C, and this resulted in a coke consumption of under 12 cwt.

The refractories used in the furnace were supplied by General Refractories, Limited. The stack was in Foster crown and Foster high grade qualities, the bosh in Foster crown and the hearth in Foster carbon. Half way through the campaign the stack had to be repaired and it is thought that this was due to the inadequate method of cooling which was partly due to the use of short coolers and the position of the coolers. During the repair, many more coolers were used in the area of failure and no further trouble was experienced for the remainder of the campaign.

In view of the experience from this last campaign, it was decided to again use a full carbon hearth of Foster carbon. To avoid the possibility of stack failure, the number of coolers will be doubled and the coolers will be of sufficient length to cool the whole of the brickwork to within 9 in. of the working face.

FINANCE CORPORATION FOR INDUSTRY

FINANCE in connection with developments in the steel industry still constituted the greater part of the business of the Finance Corporation for Industry, Limited, stated Lord Sinclair of Cleeve (chairman), at the annual meeting on Wednesday. In general these developments were proceeding satisfactorily—indeed in some cases they were ahead of schedule.

To fulfil the purpose of the corporation it was necessary that it aided the development of projects of national importance which could not obtain at the time finance through the normal channels. The corporation therefore sought to build up resources and had increased the general reserve to £1,750,000 by transfer from profit and loss.

Passing Thoughts . . .

SIR ROBERT MACLEAN

MY impression is that the production costs in the Common Market are rising more quickly than our own. If this be true, Britain may well find itself better off outside the Common Market than inside.

Today, Common Market countries take about 25 per cent. of Britain's exports. If half of this is lost, as it might well be, the effect would be serious, but would it be disastrous? We have to remember that the Commonwealth represents 40 per cent. of our export trade and the Commonwealth market is growing.—SIR ROBERT MACLEAN, chairman of the Council of the Scottish Chambers of Commerce.

Rank-and-file trade unionists . . . are wont to expect leadership on the cheap, and because of this niggardly attitude there is a real danger of trade unions failing to attract able young men to serve them.—The Scotsman.

Far too many people, in designing new public and commercial buildings, as well as houses, have turned their backs on coal without any consideration for the future. The appeal of oil is, to a large extent, a snob appeal. It is not in all circumstances based on relative efficiency, and completely disregards difficulties which might arise in supplies if this country became involved in an emergency arising from some international incident or the difficulties over balance of payments.—MR. S. W. G. FORD, president of the National Union of Mineworkers, speaking at the Yorkshire Miners' Gala.

The steel industry has moved out of a sellers' market into a buyers' market. It will almost certainly have to accustom itself in the years ahead to paying its way on a lower average utilization of capacity than in the past. This is a matter on which it can legitimately expect some co-operation from the Iron and Steel Board.—Financial Times.

Tariffs or no tariffs, British industry possesses all the markets and all the stimulating competition it wants at home and all over the world, witness our continuing conditions of full employment and inflation. A new market in Western Europe in our present situation will merely add to the length of industrial order-books and the length of shipment delays.—VISCOUNT HINCHINGBROOKE in a letter to the Times.

Register of Restrictive Trading Agreements

DIRECTION to the Registrar of Restrictive Trading Agreements has been given by the Board of Trade, authorizing the Registrar to remove from the Register all particulars of the agreement between members of the Coal Preparation Plant Association.

The Act provides that such direction may be given when particulars of the trading agreement appear to be of no substantial economic significance.

Steel Prices Increased

NOT ENOUGH—OR TOO MUCH?

PERMITTED increase in the maximum prices of iron and steel products of 1 per cent. on all items, which was announced by the Iron and Steel Board last Friday and which came into force on Monday, has, as might have been expected, met with a mixed response, none of it very favourable. The steelmakers have been unanimous in regarding the increase—which is estimated to average about 10s. per ton on items controlled by the board—as "totally inadequate." The shipbuilding industry regards even 1 per cent. as a further serious handicap in its efforts to meet the fierce competition from foreign yards.

The British Iron and Steel Federation, which asked as long ago as last February for permission to raise prices by about 3 per cent., stresses the inadequacy of the increase in balancing the additional burden of costs—coal, transport, wages, and fuel oil tax—which has risen still further since it made its application in February.

The consequential increase in the industry's earnings is estimated at a rate of £7,500,000 a year over the second half of 1961, the federation states. Over the same period additional costs are estimated at a rate of £25,000,000 a year, after taking into account all expected savings from greater efficiency.

"Regrettable but Inevitable"

A similar point was made by Mr. C. H. T. Williams, managing director of the Park Gate Iron & Steel Company, Limited, Rotherham, and this year's Master Cutler. A spokesman for the United Steel Companies, Limited, Sheffield, said: "We must go further than this before we are able to recoup the costs already incurred in the price of coal and wage increases."

The Shipbuilding Conference views the Iron and Steel Board's decision "with grave concern," not only on the grounds that it will handicap the industry still further, but also because it will hit those firms who have secured new orders recently at fixed prices.

Pointing out that any increase affects not only the cost of the hull but practically every item of main and auxiliary equipment which goes into the building of a ship, the Conference states: "This increase represents the reversal of a trend which ruled during the past three years and must be viewed with disappointment and anxiety."

The view of the National Union of Manufacturers is that increases in steel prices should be restricted to actual proved increases in costs and, assuming that the board has given full weight to this consideration, accepts the increase in price as "regrettable, but inevitable."

Lincolnshire Iron-Ore Output

PRODUCTION of iron ore from the mines and quarries of North Lincolnshire rose during the first four months of this year to an average of 117,700 tons, an increase of 12,800 tons on the comparable period of 1960. Production for the district during April was running at 110,900 tons a week, compared with 107,700 tons in April last year.

While the Frodingham bed, the biggest single producer of British ore, was pushing up its output graph, national output declined during the month.

Lodge-Cottrell Contracts for Precipitators

LAND boiler consortium, Foster Wheeler-John Brown, Limited, has, on behalf of the Central Electricity Generating Board, instructed Lodge-Cottrell, Limited, a member of the Simon Engineering, Limited, group to supply precipitators for four 350mW boilers at Tilbury power station. The contract value is about £1,100,000.

The flue dust produced by the four pulverized fuel-fired boiler units will be partially removed by mechanical collectors, and final cleaning will be carried out of 12 electro-precipitators, three to each unit. Each precipitator will be of the three-stage, horizontal gas flow, high-efficiency design and each group will handle 990,000 cu. ft. of gas per minute (continuous maximum rating) at 270 deg. F. with a guaranteed collecting efficiency of 99.3 per cent.

A further five precipitators for the Lackenby steel plant oxygen-blown open-hearth steel furnaces of Dorman, Long & Company, Limited, are to be supplied by Lodge-Cottrell. This makes a total of six furnaces to be supplied with precipitators at a contract value of some £440,000. Plant for each furnace will consist of one four-stage horizontal flow high-efficiency electrofilter, together with all the necessary transformer rectifier equipment, etc.

Another Record Year for Sheffield Twist Drill?

FOLLOWING last year's record turnover, sales of the Sheffield Twist Drill & Steel Company, Limited, in the first five months of 1961, show a further improvement over the corresponding period of 1960 and Mr. A. Dormer, the chairman, expects another prosperous year for the company.

Steps continue to be taken to counteract the increasing cost of production, and the processing of the company's own raw materials is contributing towards this. Although last year's exports were a record, increasing by 47 per cent. over the 1959 figure, Mr. Dormer warns that costs are high. The directors look forward confidently to a big increase in sales in Europe if the UK becomes a member of the Common Market.

In order to improve sales in Canada a subsidiary has been formed there which is financing, through the parent company, the holding in a warehouse company formed in conjunction with six other UK manufacturers. Sales are satisfactory.

Personal

Honour for Bedford Industrialist

MR. W. K. G. ALLEN, who was knighted in the recent Birthday Honours, is not only the head of the firm of Bedford engineers, W. H. Allen Sons & Company, Limited, but has a wide variety of interests both in industrial and social affairs.

MR. W. K. G. ALLEN

Mr. Allen, who was born in 1907, joined the board of the company in 1937, became managing director in 1946, and chairman in 1955, succeeding his uncle, the late Sir Richard W. Allen, and so becoming the third member of the family to hold the chairmanship since the company was founded by his grandfather in 1880. He is also a director of Whessoe, Limited, engineers to the nuclear power, coal, gas, and petroleum industries, of Darlington.

For many years he has been actively associated with important bodies and associations in the industrial sphere and is a member of council and past chairman of the British Internal Combustion Engine Manufacturers' Association, a member of council and past president of the British Engineers' Association, and a counsellor and immediate past chairman of the British Electrical and Allied Manufacturers' Association. He is also first deputy president of the Engineering Employers' National Federation, chairman of the Nuclear Energy Trade Associations Conference, and chairman of the British National Committee of the International Congress on Combustion Engines. He was a member of the Minister of Power's Industrial Coal Advisory Council. His interest in local affairs ranges from membership of the Apsley Guise Parish Council and the Bedfordshire County Council, to the county which he served as High Sheriff in 1958-59.

Mr. ALLEN L. STOCK, chairman of the Morgan Crucible Company, Limited, has been re-elected chairman of the London Chamber of Commerce.

Mill office manager at the Cargo Fleet works of the South Durham Steel & Iron Company, Limited, Middlesbrough, Mr. CHARLES H. BRADY has retired.

Mr. W. R. JONES, managing director of George Clark (Sunderland), Limited, marine engine builders, is retiring next month after 40 years with the Richardsons Westgarth group of companies.

Mr. WILLIAM ERSKINE (84), foundry manager at the Wallsend Slipway & Engineering Company, Limited, Wallsend-on-Tyne, has completed 50 years with the firm. He joined the firm as a pattern shop foreman.

Mr. A. RAMSKILL, assistant manager of the Wolverhampton branch office of the English Electric Company, Limited, was the winner of the 12th annual golf competition organized by Bradley & Foster, Limited, makers of refined pig-iron, metallic abrasives, etc., of Darlaston (Staffs), a member of a Staveley Industries, Limited, group. Nearly 100 industrialists from all parts of the Midlands competed for the cup, which bears the name of the president of Staveley Industries, Mr. T. A. KcKenna.

Mr. W. E. LAMB, sales director of the Cambridge Instrument Company, Limited, has just completed a tour of the North American continent, where he held informal conferences with leading representatives of American industry, in conjunction with Mr. R. H. Kruse, president of the Cambridge Instrument Company, Inc, New York.

Assistant production manager of Aberdare Cables, Limited, Mr. G. R. BISH has been awarded first prize in the Intermediate Certificate in Management Studies at Glamorgan College of Technology. A past Andrew Carnegie research silver medallist in ferrous metallurgy, he is a member of a research committee of the British Non-Ferrous Metals Research Association.

Managing director and deputy chairman of J. & J. Dyson, Limited, of Stannington, Sheffield, Mr. G. A. LOMAS has been elected president of the Refractories Association of Great Britain. He spent two years at Sheffield University in the Faculty of Metallurgy studying refractories, before joining the then family company of J. & J. Dyson, after a period in the Royal Air Force.

Visitor to the British Iron and Steel Research Association's open day in Sheffield last week was Mr. DENZIL FREETH, Parliamentary Under Secretary to the Minister of Science. He was accompanied on the tour by Sir CHARLES GOODEVE, director of BISRA, and the local director, Dr. JOHN PEARSON. Mr. Freeth saw a demonstration of continuous steel casting and other processes.

At the first annual meeting of Coventry branch of the Institution of Works Managers, Mr. N. H. WILSON, of Sir W. G. Armstrong Whitworth Aircraft, Limited, was elected chairman, Mr. L. B. RUTTER, of Automotive Products Company, Limited, Leamington Spa, was elected deputy chairman, and Mr. A. L. Patchett, of Lockheed Hydraulic Brake Company, Limited, was re-elected branch secretary.

The QUEEN and the DUKE OF EDINBURGH were received by Mr. A. G. Steward, the chairman, and Mr. William C. Bell, managing director, when they visited the Corby (Northants), steelworks of Stewarts and Lloyds, Limited, on Monday. They watched 140 tons of molten steel being poured from an open-hearth furnace. The Queen and the Duke lunched with the chairman and the directors of the company.

Sir WILLIAM STANIER, a director of H. W. Kearns & Company, Limited, machine tool manufacturers, of Altrincham, has been elected president of the Production Engineering Research Association. Sir BASIL R. G. TANGYE, director of Tangyes, Limited, has been re-elected chairman of the PERA council, and Mr. A. L. STUCHBERY, of the Metal Box Company, Limited, and Mr. G. R. PRYOR, chairman and managing director of Edward Pryor & Sons, Limited, have been re-elected vice-chairmen.

Cllr. JOHN WAINWRIGHT, of Wigan, who was made CBE in the Birthday Honours last week, was manager of Winstanley Collieries, Limited, from 1924 until the firm closed in 1927. In 1928 he formed a small colliery company, Billinge & Winstanley Colliery Company, Limited, and was managing director for 25 years. He is at present consultant to the Windy Arbour Colliery Company, Limited, Winstanley, near Wigan. For the past 15 years he has been chairman of the Federation of Small Mines of Great Britain, and for 10 years before nationalization was chairman of the South West Lancashire Coal Owners' Association. He is a JP and former chairman of Billinge and Winstanley District Council.

EXPORTING TO GERMANY

"Wide Open" Market for British Firms

"WEST GERMANY is a tremendously exciting and challenging market, particularly in the breadth of opportunity and the encouragement given to imports. Industry is booming, demanding more and more plant and mechanization and causing bottlenecks in production which British firms might well fill." This is the message given to UK exporters by Sir William McFadzean, chairman of the Export Council for Europe, and chairman and managing director of British Insulated Callender's Cables, Limited, in the second report of the council on trading opportunities for British firms.

In the report, which is this time devoted wholly to West Germany, Sir William points out that, although British exports there have trebled since 1955 and doubled since 1958 and, including re-exports, are now running at the rate of about £190,000,000 a year, this still represents less than 5 per cent. of Germany's present imports. He adds: "Our mission has no hesitation in saying that these figures could and should be substantially increased."

An eight-man fact-finding team, drawn from members of the council and led by Sir William, toured the chief industrial centres in West Germany in May, and their report contains their principal findings and recommendations, together with statistics on various products not previously published.

Sustained Effort Needed

Sir William says that to succeed in West Germany, a substantial and sustained effort is required. Firms which "expect quick results," or who are not prepared to stay, should not attempt to start. "Those who go in, paying full attention to the requirements of this great market will, we are confident, not be disappointed."

The report describes Germany's door as still "wide open" to British exporters, if they can match the best in quality, price, or technical efficiency. "Both actually and potentially, the market is a tremendous one and this is the right moment to enter it." Mentioning several distinct areas where an effective effort could now be made, the report notes West Berlin which, with a population of over 2,000,000 is not only West Germany's greatest city but also its largest manufacturing centre. Berlin's imports rose by 25 per cent. to £6,500,000 in 1960, but Britain's share of this was only 8.6 per cent., a figure which "could be increased substantially by a stronger selling effort."

With German industry so fully employed, mechanization, automation, and all forms of labour-saving equipment are increasingly wanted, says the report, which adds, however, that firms which have gained a foothold in the country should be prepared to maintain their effort. Technical and after-sales service is a prerequisite to sales of all plant and equipment. The German buyer is impressed by British quality, but insists that parts should be available immediately. Sales, promising at the outset, have been lost through lack of attention to this point.

German manufacturers of capital goods and machinery, the report points out, have to contend at present with a number of production bottlenecks. Deliveries have been delayed and some important gaps have opened which British firms could fill. Although there will always be a market for specialized equipment, the present position has revealed additional opportunities for such goods as electronic equipment and components, machine tools for metal and woodworking, marine pumps and engines, and specialized tools for aircraft and shipbuilding industries.

Other goods for which there are increased outlets include refrigeration equipment, printing and textile machinery, laundry equipment, scientific and measuring instruments, earth-moving and land drainage equipment, and iron and steel goods. With Germany's post-war rebuilding programme still in full swing and earlier restrictions on foreign tenders lifted, constructional equipment of all kinds is in demand, but "must comply with stringent building and safety regulations." Agriculture so far is not as highly mechanized as in Britain, and there is a growing market for all types of machinery and implements.

There are no complaints, says the report, regarding the quality of British machine tools. German users acknowledge these to be among the finest available, although some designs are considered old-fashioned. German machine-tool manufacturers, however, have recently reduced their prices and delivery times in order to match foreign quotations, it is warned, and there is a tendency for German industrial buyers to prefer home makes where price and delivery terms are similar.

British manufacturers are advised, before attempting to enter the German market, to carry out careful market research, preferably in consultation with the British consulates who are able to make specialist advice available. Consideration ought sometimes to be given to manufacture or assembly under licence, or to setting up subsidiary companies. "Experience has shown that in this way, even direct sales can be increased because of the greater volume of overall sales, and the need for auxiliary or complementary products this involves."

Steel Industry for Rotterdam to be Studied

WITH the co-operation of the US Steel Corporation and using ore from Labrador, the possibility of the establishment of a steel industry in Rotterdam is being investigated, according to an official statement.

A spokesman said the municipality of Rotterdam was at present engaged in negotiations with the Société d'Economie et Mathématique Appliquées and the US Steel Corporation for a joint investigation with the purpose of advising on the economics involved regarding an integrated iron and steel plant at Rosenburg.

Law Cases

Claim by Electrician's Widow Against Colvilles Fails

WIDOW'S £5,000 claim against Colvilles, Limited, Motherwell, was rejected in the Court of Session. The action was by Mrs. Elizabeth Knight (62), widow of Mr. John Patrick Knight, who was employed by Colvilles as an electric motor attendant. He was electrocuted at work in 1957. Mrs. Knight alleged that Colvilles contravened the regulations for the prevention of danger in a power station.

Lord Wheatley said it was part of Knight's duty to clean the transformer of a rotary converter, while it was not in operation. On the day of the accident he collected the key of the power station, and shortly afterwards two electricians in another part of the premises noticed that the lights were blinking. Almost immediately the lights went out. Knight was found unconscious with signs of burning on his hands. He died later in hospital. It was inferred that he had come in contact with one of the five terminals carrying 11,000 volts.

Lord Wheatley held it was not reasonably foreseeable that a person would be in a position to be anywhere near a live terminal when the rotary converter plant was in operation. The transformer was housed in a compartment which was kept locked. The key had to be brought down from a floor upstairs and a door marked "Danger" opened. He held that Knight had been fully instructed and knew the danger of cleaning the transformer while it was live. The only reasonable explanation seemed to be that he suffered from some mental aberration. The precautions taken by Colvilles were sufficient.

£1,500 DAMAGES FOR "LATCHER"

DAMAGES totalling £1,500 were awarded to Mr. William Raymond Davies (49), at Monmouthshire Assizes by Mr. Justice Atkinson, following an accident while working as a "latcher" at the Ebbw Vale works of Richard Thomas & Baldwins, Limited, in 1958.

Mr. Davies, whose job was to get off a moving train carrying limestone, loosen catch points, and remount the train, fell and was dragged along the track. The judge stated there was obvious risk in the system governing the work of latchers and the defendants were negligent in allowing it to continue.

STEELWORKER LOSES CLAIM

AT Consett County Court, Judge Drabble dismissed a claim for £400 damages against the Consett Iron Company, Limited, by Mr. Joseph Wright (39), who was splashed by molten metal and burned. The accident occurred when the metal erupted in a mould.

Giving judgment with costs for the company, the judge said there had been no evidence that eruptions in metal could be prevented, and as long as the risk was present men working on such processes were in danger. No further precautions could have been taken by the company.

A MINER, James Buchanan Westwater, was fined £10 at Kirkcaldy Sheriff Court after admitting sleeping below ground at Rothes Colliery, Thornton (Fife).

AT MONMOUTHSHIRE ASSIZES, Norman Cecil Probert (39), had his claim for damages against his employers, Richard Thomas & Baldwins, Limited, dismissed. Probert was stated to have slipped while climbing out of a pit at a reduction mill.

DAMAGES totalling £100 were awarded to Mrs. J. McLoughlin against the Steel Company of Wales, Limited, at Newport (Mon) County Court, on behalf of her late husband, for breach of statutory duty and negligence by the company which led to Mr. McLoughlin injuring himself when he tripped over the cable of a cooling fan at the Orb Works (Newport). It was stated that Mr. McLoughlin's death had no connection with the accident.

More Welsh Coal Needed to Retain Markets

UNTIL the new and reconstructed deep mines in South Wales, in which the National Coal Board has invested large sums of money, reach full output, there would be a shortage of the types of coal they produce, said Mr. Alfred Robens, the NCB chairman, in a letter to Neath Urban Council. His request that the council discuss with the Opencast Executive or the NCB the extension of the Maesgwyn open-cast mine at Glyneath was agreed.

Mr. Robens' letter mentioned anthracite and coking coal and he said: "If we are to hold the markets for these collieries until they are able fully to satisfy demand, it is essential that some other source of supply should be found quickly as a stop-gap." He went on: "Every possible way of doing this has been carefully considered, and it is clear that the only answer is to increase output by open-cast working in South Wales." If markets were lost to alternative fuels, it would affect the economy of South Wales, he added.

Mr. Robens asked the council to co-operate with the board to retain the markets by obtaining working rights for new open-cast sites with a minimum of delay, so that increased output would be effective from next autumn onwards.

Mr. J. C. George at NCB Central Engineering Establishment

IF the National Coal Board can get coal at the face cheaper, transport it at less cost, and prepare it better for the market, the industry will go a long way to retaining its position, Mr. J. C. George, Parliamentary Secretary to the Ministry of Power, said at the NCB's Central Engineering Establishment at Bretby (Derbyshire).

Discussing the work of the establishment, Mr. George said that Bretby was helping to ensure that technical advances in the coalfield would keep pace with the competitive challenge that faced the industry.

A SPECIALLY-DESIGNED automatic rotating equipment for the ultrasonic examination of large forgings has been installed in the Atlas Works of Thos. Firth & John Brown, Limited, Sheffield. These examinations have previously been carried out at the works manually, but the more highly stressed nature of the larger and heavier rotor forgings has increased the importance of examination and manual manipulation is almost impossible with the increase in weight.

PLAIN STATEMENT

Iron and Steel Board's 1960 Report

WITHIN the comparatively brief compass of 42 pages, the 1960 report of the Iron and Steel Board, published on Wednesday, ranges over the vast field covered by the industry for a period which may come to be regarded in retrospect as one of the most significant in the long history of iron and steel. The report remains, however, a plain statement of facts—from the opening sentence of the introduction to the conclusion of the final chapter.

Steel production in 1960 at 24,300,000 tons was some 4,000,000 (20 per cent.) more than in 1959 and with imports over 1,000,000 tons higher, the total increase in steel supplies was nearly 5,250,000 tons. Although home consumption increased by about 2,000,000 tons, a similar amount was added to stocks. The imports included the equivalent of 500,000 ingot tons. Exports at 4,080,000 tons were a post-war record.

In the first half of the year the pressure of demand was acute, particularly from the motor car and consumer goods industries. The situation later eased as demand from these industries lessened, but the requirements of the constructional engineering industries continued to rise.

Prospects for 1961

There was no increase in the general level of prices, although on balance costs rose. Steelmaking capacity increased by 1,000,000 tons and will rise by a similar amount in 1961. Many fresh development projects came forward in 1960 and several major schemes, notably the new wide strip mills will be nearing completion by the end of 1961.

So far as the immediate prospects are concerned, the report states, there has been uncertainty about the level of activity in the car and consumer goods industries whose output declined towards the end of last year. It recovered early in 1961 and the prospects for sheet production are now better. Activity in the capital goods and constructional engineering industries which take the bulk of steel output, is being well maintained. The industry is endeavouring to secure a further increase in exports this year, although severe competition may limit the increase.

The rate of increase of stocks held by consumers and merchants is not expected to be as large in 1961 as in 1960 and total demand in 1961 may therefore show a fall. Production should be between 24,000,000 and 25,000,000 tons from a capacity of 27,000,000 tons, and the additions to blast-furnace capacity will enable the extra steel output to be achieved without significant imports of pig-iron and scrap.

The motor industry was active in the early part of the year but output later declined and this affected the market for sheet. Activity in the plant and machinery and building and wire trades was high which resulted in a strong demand for many products including billets, plate, sections, reinforcing bars, and wire rods. Demand from the railways, coalmines, and shipyards continued low.

Exports at 2,900,000 finished tons were 81,000 tons higher than in 1957, the previous best post-war year and 218,000 tons higher than in 1959. The increase in 1960 as compared with 1959, which was spread over many countries, was particularly marked for plate, heavy sections, and tinplate. Exports of sheet and some light rolled products were limited by supplies, while the demand for rails and oil pipe was weak. Imports, at 1,200,000 tons, were three times larger than in 1959 and about half was sheet, most of which came from the US and Europe.

Although production was high, supplies of raw materials and fuel were generally adequate and only small imports of pig-iron and scrap were required to make good local shortages. Some 5,900,000 tons of scrap was bought from home sources and 15,800,000 tons of pig-iron was produced, as against 4,800,000 and 12,600,000 tons in 1959. Pig-iron production was 10 per cent. greater and output per furnace 30 per cent. higher than in 1957, the previous best year. Home production and imports of iron ore were both at post-war record levels.

In September the National Coal Board raised coal prices and the price to the industry of coking coal rose by an average of 8s. 11d. a ton and non-coking coal by 6s. 1d. a ton. Following these changes blast-furnace coke prices were also increased by 15s. 2d. to 18s. 7d. a ton. The board registered with the Minister its concern at the effect of the coal price increases on the competitive position of the iron and steel industry in oversea markets. The previous relationship between the price of UK and continental coals has been changed, although the change has been partly offset by the revaluation of the Deutschmark. The Durham price is now on average £5 10s. 3d. a ton as against £5 0s. 6d. before the increases and the Ruhr price (which has risen in terms of sterling because of revaluation) is on average £5 9s. a ton as against £5 4s. before revaluation. (Ruhr prices exclude sales/turnover tax which might be payable on some coal used by the iron and steel industry). Coking coal prices in the ECSC have been steady for three years and the indications are that this stability is likely to continue.

The price of US coal delivered to European coastal works has recently fallen owing to lower freights and to lower pithead prices to about £5 a ton, while British coal costs on average £5 18s. a ton at coastal sites. The High Authority of the ECSC expects American coal to be available at under £5 10s. a ton for a long period ahead and substantial use of American coal at European coastal works is expected.

The board has drawn the attention of the Minister to the discriminatory nature of the increases, as coking coal prices rose by more than gas coal even when similar coals are used by both the gas and steel industries. It also seems to the board that the price of coking coal is unduly high in relation to that of large coal.

Referring to costs, the report states that on balance

costs rose, between the beginning and the end of 1960, by the equivalent of £25,000,000 a year, against which there were reductions in the cost of imported materials equivalent to £9,000,000 a year and higher productivity and other savings equivalent to £7,000,000 a year. Setting one against the other, costs at the end of the year were some £9,000,000 or 10s. a ton higher than at the beginning. (The incidence of the higher costs was most marked towards the end of the year.)

Prices were changed on three occasions. In February the maximum prices of hematite pig-iron, most heavy steel products, and tinplate were reduced. This represented a benefit to consumers of over £4,000,000 a year totalling, with earlier price reductions, more than £20,000,000 a year, or between 2½ and 3 per cent. of average selling prices. The other two changes did not alter the general level. In fact, before the coal price increase was announced in September, some further reductions in iron and steel prices had been expected following a review of the operating and capital costs which might be looked for at a first-class modern plant. But the higher coal prices removed the possibility of any general reduction in iron and steel prices and it was decided to hold the existing price level.

Home and Export Values

The annual value of steel products covered by the board's price determinations and sold in the home market was nearly £800,000,000 as against £675,000,000 in 1959. Exports (not controlled) totalled £150,000,000 at home trade prices, as against £125,000,000 in 1959. Broadly speaking, prices in the UK are still between those of Thomas (*i.e.* basic Bessemer) and open-hearth qualities in the Community countries, and below prices in the US. The UK advantage over the Community is most marked in thick plate, thin sheet, and tinplate. The Community's advantage is most marked in re-rolled bars and sections, wire rods, and hot rolled strip in Thomas quality.

The board's third special report on development, which deals in detail with the prospects of the industry up to 1965 and looks forward more generally to 1970, is recalled. It puts the crude steel requirements in 1965 at 29,000,000 tons and the appropriate capacity at 32,000,000 tons. After allowing for the withdrawal of capacity which may be uneconomic by 1965, the amount of modern and efficient capacity is likely to be close to 32,000,000 tons.

The 53 proposals approved by the board during 1960, estimated to cost £223,000,000, represented the greatest volume of schemes yet approved by the board in any year. Among the significant features of these schemes are:—

The further expansion of iron and steel making capacity based on home ore; increasing use of oxygen in steel making; further plans for the adoption of continuous casting; and the expansion and modernization of facilities for the manufacture of light rolled products, especially wire rod and bar in coil.

The industry spent £146,000,000 on expansion and modernization in the year, 47 per cent. more than in 1959. Expenditure in 1961 is expected to be substantially higher.

Dealing with technical advances and research, the report states that the number of large blast furnaces, open-hearth and converter steel furnaces has increased markedly over the past decade. In 1960 there were 14 blast furnaces of over 25-ft. hearth diameter as against one in 1950, 27 200-ton fixed open-hearth steel furnaces (none), and 18 300-ton tilting open-hearth furnaces (nine).

There was growing interest in 1960 in injecting fuels such as oil and pulverized coal into the blast furnace in order to partially replace expensive coke with cheaper fuels. Trials of oil injection have been undertaken, notably at the Steel Company of Wales, Limited, where it is planned to provide oxygen to enrich the air blown to the blast furnaces and at the Ebbw Vale Works of Richard Thomas & Baldwins, Limited. In order to raise crude steel output four works announced plans in 1960 to build oxygen-blown converters.

The fact that by the mid-1960s there will be 13 arc furnaces each of over 60-tons capacity in the Sheffield area alone, illustrates the growing recognition of the advantages of using large electric furnaces for bulk steels as well as special steels. Five large schemes to install continuous casting plants were submitted during 1960.

Productivity increased by 23 per cent. between 1954 and 1960. Much of the increase in productivity is attributable to the heavy investment in recent years, and the benefits would not have been so fully realized but for the good relations between companies and the trade unions, for long a feature of the industry.

The steel industry spent nearly £4,000,000 a year on research in 1959 as against £2,500,000 in 1954/5. In 1958/9 the ironfoundry industry spent about £550,000 and the steelfoundry industry about £220,000, making £4,700,000 in all. The board has set up a technical advisory panel with 10 members drawn from within the industry and from outside.

Output of iron castings in 1960 at 3,970,000 tons was a record and 13 per cent. higher than in 1959. It may, however, be difficult for some sections of the industry, notably makers of ingot moulds and automobile castings, to maintain this level of output in 1961. Higher coke prices are estimated to have added nearly £1,000,000 a year (or 4s. 9d. a ton of finished castings) to the industry's costs. The capital expenditure by ironfoundries in 1960 was £9,000,000 (£6,000,000 in 1959), the main emphasis being on mechanization, modernization, and improvement of working conditions.

Finally the report deals with international relations and such other matters as safety, health and welfare, training and education, and trading practices and competitive conditions.

The 10 appendices deal in greater detail with items in the report, such as demand and supply, standard specifications for steel, requirements and availability of raw materials and fuel, movements in individual cost items, price comparisons, etc.

Foundations are Completed at Spencer Steelworks

WITH the completion of the foundations for the steel-framed buildings at the Spencer steelworks of Richard Thomas & Baldwins, Limited, at Llanwern (Mon), the three-quarter-way stage of foundation work has been reached. Despite the poor weather, the contractors have met on time all the programme requirements of the largest civil engineering contract placed in Britain by one firm. Production is expected to begin next April.

Already 90,000 concrete piles have been driven on the 1,700-acre site, and the final few thousand cu. yds. of filling is being carried to the site. The level of the site in places had to be raised by 5 ft. to 6 ft. by importing about 8,500,000 cu. yds. of filling.

TILLEY LAMP COMPANY, LIMITED—Mr. N. A. Whitaker has been appointed joint managing director and Mr. R. Grimble a director.

REVIVAL BY INDUSTRY

More New Orders, Increase in Exports

LATEST survey by the Federation of British Industries on trends in UK industry shows that there has been a revival in new orders, a consequent lengthening of order-books, and an increase in output, compared with the situation when the last survey was taken in February. Stocks at all levels have risen, and industry generally is using rather more men for longer hours. Shortage of skilled labour has again become the main impediment to increased output.

Industrialists who answered the latest FBI survey, prepared at the beginning of this month, were generally more optimistic about the outlook than four months ago. A disquieting feature, however, is that half the firms questioned were still working below full capacity.

In February it was pointed out that the balance of firms reporting a rise in costs was the highest since inquiries began. This time, a further substantial rise in costs is suggested, coupled with a much smaller rise in selling prices and a further lessening of profit margins. The increase in the balance of firms reporting a rise in costs and a fall in margins was greater than expected—a situation to which the rise in fuel oil tax may have contributed, it is stated.

Exports Inquiry

The chief limiting factor to expansion has once again become shortage of skilled labour. This has replaced lack of orders, the chief difficulty four months ago. Investment continues, however, and over the new year it is expected that less will be spent on building and rather more on plant.

A detailed inquiry was this time made into exports which showed a significant improvement in the rate of new export orders and deliveries for the first time since a year ago. The improvement, however, is less than that shown for the home trade.

The replies to the questionnaire showed that despite a rise in export orders on hand, delivery dates have been shortening somewhat and that more orders have been booked at lower prices, in contrast to the reported rise in prices for the home market, and the general rise in unit costs of production. Despite this fall in prices, however, the comparative price level is by far the most serious short-term problem facing exporters.

The broad conclusions of the inquiry are that there has been a rise in orders and output, but this applies more to the home than to the export markets. The most disturbing factor is the continuing rise in production costs, particularly as price is seen to be the main obstacle to higher exports.

The current market prospects can be grouped as follows:—Significant improvement—North America, the Six, the Seven, and the Communist Block; little improvement—Central and South America, Middle East, South-East Asia, and Japan; moderate worsening—Australasia, Africa, and India.

SUBJECT OF A one-day conference of the British Institute of Management to be held at the Connaught Rooms, Great Queen Street, London, W.C.2, on July 4, 1961, will be the Cost of Labour Turnover.

East German Order for UK Rolling Mill Equipment

ROLLING mill equipment worth £1,250,000 is to be bought by East Germany from the Loewy Engineering Company, Limited, a subsidiary of Tube Investments, Limited. The equipment consists of extensive installations for the rolling of aluminium strip and foil, and the signing of the contract concludes negotiations which started in March at the Leipzig Spring Fair.

The total value of contracts signed at the Leipzig Fair was approximately £5,000,000, but the largest potential order—for £45,000,000 worth of steel-rolling mills and other steelmaking equipment—remained unplaced. Negotiations between the East German Government and Loewy Engineering are, however, still going on.

Announcing the Loewy contract, Herr Gunther Steffen, director of the East German Ministry of Foreign Trade, who on his visit to London has been engaged in other talks involving orders worth about £100,000, regretted the Board of Trade restrictions on commerce between East Germany and the UK, and expressed the view that the present quotas (for £9,000,000 in each direction) could easily be doubled.

Industry's Capital Spending on the Increase

OVERALL capital spending by industry in the first quarter of this year was 3 per cent. above the last quarter of 1960, according to figures published by the Board of Trade Journal. Manufacturing industry's spending was 5 per cent. up on the December quarter, but it is estimated that the heavy stockbuilding has come to a halt.

Provisional estimates suggest that the volume of stocks and work in progress of manufacturing industry (at 1954 prices) after seasonal adjustment rose by £12,000,000 in the first quarter, a small change compared with the increases recorded each quarter since the middle of 1959.

STEEL PRODUCTION at the Clydesdale Works of Stewarts and Lloyds, Limited, resumed on a normal basis last week after one week's shut-down to reduce a stock of ingots which had accumulated because of a slower rate of operations in the tube mills.

Orders Placed

Gas Cleaning Plant for Electric Arc Furnaces

WHEN Steel, Peech & Tozer, branch of the United Steel Companies, Limited, announced its £10,000,000 scheme for the replacement of all existing open hearth steel melting furnaces by six 110-ton oxygen lanced electric arc furnaces, it was stated that special attention would be given to the selection of fume extraction equipment.

An order has now been placed with the gas cleaning division of W. C. Holmes & Company, Limited, to supply gas cleaning plant for each of the first two furnaces to be installed at the Templeborough Works. Each installation consists of a direct fume extraction system, an electrical precipitator, and a common water treatment plant. Completion of the first installation is scheduled for October 1, 1962, and the second for February 1, 1963.

ELECTRICAL AND mechanical engineers and iron-founders, of Stamford (Lincs), Arthur Lyon & Company (Engineers), Limited, has received a repeat order from Indonesia for a further 100 Alcon pumps.

CONTRACTS WORTH over £250,000 for various matrix jig borers, gear grinders, and thread grinders have been obtained by Coventry Gauge & Tool Company, Limited, as a result of its participation in the British Trade Fair in Moscow. Delivery will be made in 1963.

ORDER WORTH £310,000 has been received by the Extended Surface Tube Company, Limited, for 608,000 ft. of 2-in. dia. welded finned tube for the boilers of Dungeness nuclear power station. The steel strip will be supplied by the Lancashire & Corby Steel Manufacturing Company, Limited, and the tube by Stewarts and Lloyds, Limited.

CABLE MACHINERY worth £75,000 has been ordered from UK companies by Wandeleside Cable Works, Limited, on behalf of its associates in Poona and Bombay. The companies receiving the orders include G.W.B. Furnaces (Great Britain), Limited, B. & F. Carter & Company, Limited, Deco Machinery, Limited, and Rudkin Riley, Limited.

FOR USE IN the new paraffin and microcrystalline wax plant at the Stanlow oil refinery of the Shell Refining Company, Limited, 96 electric motors have been ordered from Associated Electrical Industries, Limited. The motors are being supplied by the motor and control gear division through Stone & Webster Engineering, Limited, London, W.C.1, and are mainly of the flameproof type.

TWO CONTRACTS for demineralization plant have been awarded to William Boby & Company, Limited, water treatment engineers, of Rickmansworth (Herts). The Air Ministry has ordered equipment to demineralize water for use in jet aircraft in the Far East, and the other contract placed through Allen & Hanbury, Limited, is for plant at a factory manufacturing pharmaceutical products in Iran.

ONE OF THE Metal Industries, Limited, group of companies, Brookhirst Igranic Company, Limited, which recently announced a £132,000 contract for the new Ford factory at Halewood, has now received a major order for the new Liverpool works of Vauxhall Motors, Limited. The company is to supply electrical controls for a gas carburizing plant, which is being manufactured by British Furnaces, Limited, Chesterfield.

Greater Demand for Coal in UK and ECSC

AN exchaneg of information and views on the energy situation and prospects in the United Kingdom and the European Community took place in London on Thursday of last week at the 11th meeting of the Council of Association between the UK Government and the High Authority of the European Coal and Steel Community.

It was agreed to set up a special working party to make periodical comparisons of energy forecasts in the UK and the ECSC.

The council also agreed to undertake joint studies of ways aimed at improving the efficiency of the coal industry through the application of modern scientific methods to mechanization. The council instructed the coal committee's working party on long-term trade prospects to continue its examination of the conditions under which mutual trade in solid fuels between the UK and the ECSC could be developed.

The council was given an account of the improvement in the coal situation in the UK and the ECSC. In the UK coal consumption rose by nearly 7,500,000 tons between 1959 and 1960. Undistributed stocks fell by more than 6,000,000 tons in 1960, and a further fall of 8,000,000 tons is expected this year. Inland demand for coal in the Community was nearly 8,000,000 tons greater in 1960 than in 1959, and exceeded production by 18,000,000 tons. Stocks were reduced by 3,500,000 tons and are expected to fall further in 1961.

Both in the UK and in the Community, 1960 was a record year for steel. In the UK production rose from 20,500,000 tons in 1959 to 24,300,000 tons in 1960, and from 63,200,000 tons to 72,800,000 tons in the ECSC. Studies by the Iron and Steel Board and the High Authority indicate that by 1965 the demand for steel will reach 29,000,000 tons (including exports) in the UK and between 87,000,000 and 98,000,000 tons in the Community countries.

Mr. Richard Wood, MP, Minister of Power, led the UK delegation and presided at the meeting. The other UK representatives were Mr. Niall Macpherson, MP, Parliamentary Secretary, Board of Trade, Mr. Alfred Robens, chairman of the National Coal Board, and Sir Cyril Musgrave, chairman of the Iron and Steel Board.

Czechoslovak Contract for Davy & United

CONTRACT worth over £1,000,000 for a mechanized plant designed for the production of railway wheels and allied products has been placed with Davy & United Engineering Company, Limited, a member of the Davy-Ashmore, Limited, group, by Strojimport, one of the national buying agencies in Czechoslovakia. The contract is said to be one of the largest ever placed with the West by Czechoslovakia and also represents the first penetration by Davy-United with heavy plant into socialist countries since the end of the last war.

The plant will be built as an extension to an existing works at Bohumin, near Ostrava, and will be capable of an initial output of 200,000 wheels a year. It has been ordered under the provisions of a current five-year development plan, and delivery is due in 1963.

This report, under the joint authorship of A. V. Malakha, V. T. Sladkoshteev, A. M. Ofengenden, A. V. Eliosoph, I. I. Druzhinin, and Yu. Z. Babaskin, is translated from Metallurg, 1960, V, No. 4, pp. 21-24. It describes the development in the open-hearth shop of the Stalinsk Iron and Steel Works of an air-cooled stopper-rod assembly for teeming steel. The assembly was put into use for the whole shop in September, 1959, and resulted in a marked reduction in stopper-rod failures and in material and maintenance costs. The authors are at the Stalinsk Iron and Steel Works and the Ukrainian Institute of Metals.

AN AIR-COOLED STOPPER FOR TEEMING STEEL

Development in a Russian Open-hearth Shop

IN the open-hearth shop of the Stalinsk Iron & Steel Works rimming, carbon, killed, and alloy steels are produced and bottom-poured to ingots weighing 3.4 tons. For assembly of the stopper, type SP-13 stopper heads are used and SP-8, SP-8-2 and SP-8-4 stopper sleeve bricks, the stopper rod being of 55 mm. (2.16 in.) dia. The metal teeming time from a ladle of 130 to 135 tons* capacity lasts from 1 hr. 10 min. to 1 hr. 30 min.

During teeming, instances have been observed where the stopper head or the lower part of the stopper has been burnt out, thus causing loss of metal and unsatisfactory teeming, with a deterioration in the quality of the steel. Such a phenomenon is generally observed in the middle or at the end of teeming, for which the data in Table I are characteristic.

TABLE 1.—*Stopper Failures During Teeming.*

	1956.	1957.	1958.
Total number of casts teemed with interruption of the pouring, per cent...	8.94	8.59	6.17
Type of interruption:			
(1) on account of the fracture of the stopper heads and the burning out of the stoppers, per cent.	7.24	5.51	3.79
Occurring:			
(*a*) at the first opening of the stopper	0.05	0.67	0.52
(*b*) during teeming of the first stool..	0.78	0.64	0.79
(*c*) at the end of teeming	6.41	4.20	2.48
(2) From metal losses due to rupture of the stopper heads and burning out of the stoppers, per cent.	1.66	1.37	1.02

In 1958, an increase in the thickness of the lower stopper sleeve bricks from 180 to 205 mm. (7 to 8 in.) reduced the number of unsatisfactory casts, but did not eliminate them.

As a result of experiments carried out, it was found that unsatisfactory teeming is caused basically by the deformation or breaking away of the lower half of the stopper rod, due to its insufficient mechanical strength, at a temperature of 1,100 to 1,300 deg. C., to which it is heated during teeming.

When deformation of the stopper occurs, the joints between the stopper sleeve bricks are opened up; liquid metal penetrates through them and fuses the stopper rod. Furthermore, deformation of the stopper complicates the entry of the stopper head into its seat in the nozzle brick, which results in leakage of metal during teeming. As metallographic research has shown, repeated use of a stopper rod gives rise to breaking away of its lower part. Under such conditions, considerable grain growth takes place, which leads to a sharp drop in the mechanical strength of the rod.

To avoid unsatisfactory teeming due to insufficient mechanical strength of the stopper rod, air-cooled stoppers have been developed and tested.†

Design of the Water-cooled Stopper

The stopper rod (Fig. 1) is manufactured from low-carbon steel tube of 57 mm. (2.25 in.) dia. with a wall thickness of 9 to 11 mm. (0.35 to 0.43 in.). The stamped and threaded section, (Fig. 2), on to which the stopper head is screwed, is welded on to the bottom end of the tube. Into the hollow rod is inserted a tube of 16 mm. (0.6 in.) external dia. and 12 mm. (0.47 in.) internal dia. through which compressed air, at a pressure of 3 to 4 atm., passes from a flexible pipe from the air supply main located on the teeming floor. Air consumption amounts to 20 to 28m.^{3}/hr. (706 to 989 cu. ft./hr.). The supply of air is switched on immediately after the delivery of a ladle to the teeming

* Metric tons are given throughout this report.

† A. B. Ivangorodsky-Klebanov, A. N. Slin'ko, M. A. Kuritskii, V. M. Streletz, N. V. Pitak, V. G. Osipov, V. B. Evtushenko, M. S. Gordienko, and A. E. Kolesnik took part in this work.

floor, and delivery continues until teeming is finished.

Passing through the gap between the inner and outer pipes, the air cools the stopper rod, and is ejected into the outer atmosphere.

In the course of research and industrial testing, a design was developed for the various components of the air-cooled stopper.

The tube, through which the air is passed to the stopper rod, is separable; one part permanently fastened to the shell of the ladle, while the other is inserted into the stopper after it has been placed in the ladle. The layout of the separable joint is shown in Fig. 3. The flexible pipe is connected in a similar manner with the compressed-air delivery tube.

The length of the bottom arm of the permanently

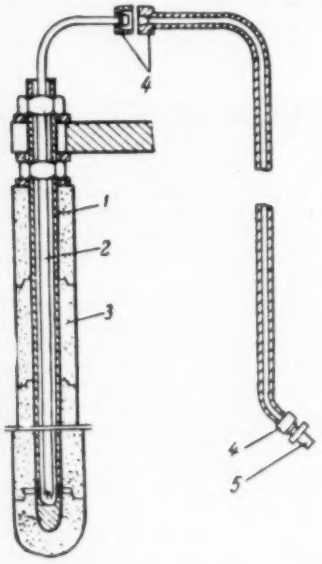

FIG. 1.—OUTLINE DIAGRAM OF THE COOLED STOPPERS.

1, Tubular rod; 2, tube through which compressed air is delivered to the stopper rod; 3, refractory stopper sleeve bricks; 4, separable joint; 5, flexible pipe.

fastened part of the air delivery tube is 600 to 700 mm. (24 to 28 in.). This prevents wear on the flexible pipe due to the action of the high temperature of the metal in the moulds.

The flexible pipes for the supply of compressed air are stored in a special cabinet on each teeming floor.

The assembly, drying, placing in the ladle, and removal of the stoppers from the ladle are all carried out in accordance with normal procedure.

The behaviour in service of the air-cooled stoppers was first of all investigated during the teeming of 50 casts. Teeming of 48 casts proceeded without breakdown of the stopper and without loss of metal.

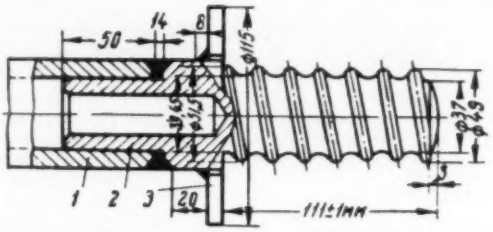

FIG. 2.—BOTTOM PART OF THE COOLED STOPPER ROD.

1, Low-carbon steel tube; 2, stamped threaded section; 3, bearing flange.

During the teeming of two casts burning out of the stopper was observed, for a reason not connected with the use of air cooling; in one instance, due to a dwell time of the metal in the ladle of 35 min. in consequence of jamming of the stopper head, the stopper overheated at the slag level before the air supply was switched on; and in the second instance tapping of the heat from the furnace lasted for 42 min., and the stopper rod was burnt through to a considerable degree, and after the air supply was turned on, teeming into five funnels proceeded normally, but on reaching the sixth funnel, a part of the stopper head was torn away, the air supply was cut off, and the stopper was burnt out.

To determine the general effectiveness of air cooling the stoppers, temperature measurements were taken of the solid and of the air-cooled rods, using chromel-alumel thermocouples, the hot junctions of which had been embedded in the rod at the time of assembly of the stopper at distances of 100 and 1,000 mm. (4 and 40 in.) from the top of the stopper head.

Fig. 4 shows that towards the end of teeming the temperature of the solid rod at a level of 100 mm. (4 in.) above the stopper head, reached 1,200 deg. C., whereas that of the tubular rod was 500 to 600 deg. C.

When the level of the metal dropped below the point of location of the thermocouple, the temperature of the cooled stopper rods fell sharply; no drop in the temperature of a solid rod was observed.

During the period from the start of tapping

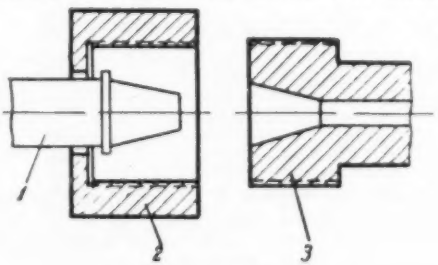

FIG. 3.—SEPARABLE JOINT.

1, Tube through which compressed air is delivered into the stopper rod; 2, push-on socket; 3, nozzle with tapered bore.

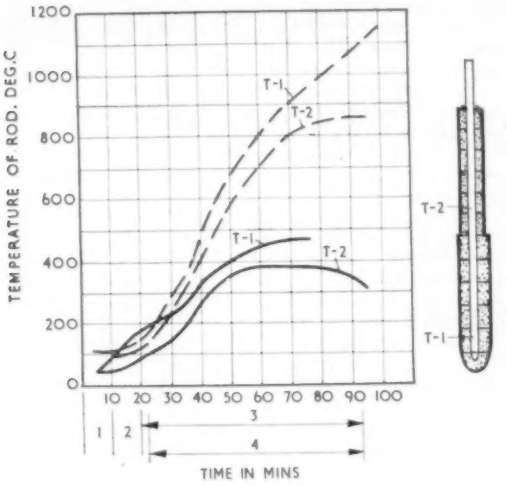

FIG. 4.—CHANGE IN THE TEMPERATURE OF THE STOPPER RODS: —T-1: THERMOCOUPLE FIXED AT A DISTANCE OF 100 MM. FROM THE TOP OF THE STOPPER HEAD; T-2: THERMOCOUPLE FIXED AT A DISTANCE OF 1,000 MM. FROM THE TOP OF THE STOPPER HEAD.

— — — — — Solid stopper rod. ———— Cooled stopper rod. 1, Tapping; 2, dwell time in ladle; 3, teeming; 4, air supply switched on.

until the moment when the air supply is shut off, on average 20 to 25 min., the temperature of the cooled rod rose to 200 deg. C. No deformation of the stoppers was observed during the teeming process. After service the tubular stopper rod was, as a rule, straight.

Observations showed that on completion of teeming and after cutting off the air supply, the temperature of the tubular rod rises to approximately 800 deg. C., on account of the heat accumulated by the refractory stopper sleeve bricks. Due to this factor, during pouring the slag out of the ladle after the completion of teeming, the rod was sometimes very slightly bent, but this was easily straightened subsequently.

After the teeming of some casts it was noticed that metal had penetrated through the joints between the stopper sleeve bricks. However, the thickness of these infiltrations of metal between the stopper sleeve bricks did not exceed 2 to 3 mm. (0.08-0.12 in.), while on account of deformation of the uncooled stoppers, infiltrations with a thickness of 6 to 8 mm. (0.23-0.31 in.) have been observed.

The basic reason for the infiltrations of metal into the joints between the stopper sleeve bricks, when the cooled stopper is used, must be considered to be the unsatisfactory quality of the mortar used for making the joint.

At the same time a study was made of the wear on the stopper sleeve bricks during the use of the air-cooled rod.

Steels of various types were teemed under approximately identical conditions. The thickness of the layer of slag in the ladle averaged 218 mm. (8.5 in.), the temperature of the metal before deoxidation was 1,623 deg. C., and the teeming time, including tapping and dwell time of the metal in the ladle was 110 min.

Under these conditions, the average wear on the stopper sleeve bricks during the teeming of carbon, rimming and killed steels was practically identical, and amounted on sleeve bricks from the Zaporozhe Works to 10 to 11 mm. (0.40 to 0.43 in.); for sleeve bricks from the Prosyanovsk Works to 8 to 9 mm. (0.31-0.35 in.) and for these two works when teeming alloy steels, respectively 7 and 6 mm. (0.27 and 0.24 in.), *i.e.*, approximately the same as when using uncooled rods. The layer of slag has a similar influence on the wear of the stopper sleeve bricks of both the cooled and uncooled stoppers.

Basically, wear on the stoppers is uniform. But during the teeming of the rimming steels individual stopper sleeve bricks wear out more rapidly. The maximum wear was 27 to 37 mm. (1.0 to 1.5 in.). It should therefore be remarked that during the teeming of rimming steel, with a slag thickness in the ladle of 450 mm. (18 in.), the wear on the sleeve bricks from the Zaporozhe Works amounted to 47 to 57 mm. (0.18 to 0.22 in.), but even in this instance the stopper was not deformed.

From September, 1959, the open-hearth shop of the Stalinsk Works changed over completely to operation with air-cooled stoppers. Since no low-carbon steel tubes were available at the works for manufacture of the stopper rods, 40 Kh.[1] steel tubes of 57 mm. (0.22 in.) dia. with a wall thickness of 10 mm. (0.4 in.) were used.

During September observation of the teeming of 143 casts was carried out. The time from the start of delivery of cooling air until the moment when it was cut off was 20 to 35 min. For certain individual casts, for one reason or another, this time was prolonged to 50 min.

As may be seen from the data given in Table 2, out of the seven casts teemed with failures there was no instance of burning out of the stoppers. But, after repeated use of the hollow stopper rods of 40 Kh steel, instances were noted of the burning out of stoppers during teeming.

It was established from the observations that after straightening of the tubular rods of 40 Kh steel, a greater number of cracks occurred, due to the increased brittleness of the steel, as a result of

TABLE 2.—*Causes of Failures During the Teeming of Casts with the Use of Air-cooled Stoppers.*

	Types of steel.			
	Rimming.	Killed carbon.	5582,6082.	Alloy.
Total number of casts teemed ..	33	54	15	41
Number of casts teemed with failures	2	2	—	3
Type of failure:				
(*a*) due to rupture of the stopper head:				
(i) at the first opening of the stopper ..	1	—	—	1
(ii) at the end of teeming	1	1	—	—
(*b*) due to wear on the ladle well block ..	—	1	—	2

which the rods fractured. In addition, low weldability of the 40 Kh steel tubes was noticed; there were instances of the fracture of the tubular stopper rods in the weld area before they were used.

From November, 1959, the open-hearth shop began to use tubular stopper rods of steel 20[2] which are easily straightened and readily welded. The rods of 40 Kh steel were no longer used.

The service life of the air-cooled stopper rods was very much longer than that of the ordinary rods. The average life of 50 stopper rods amounted to 20.3 casts.

It should be noted that, on changing over to operation with cooled stoppers, the volume of work on the production and repair of the stopper rods was cut down considerably, and metal losses were also decreased.

Solid stopper rods are straightened after each teeming operation, and the bottom part is replaced over a length of 0.8 to 1 m. (2.6 to 3.3 ft.). After four repairs the rod is taken out of service.

The tubular stopper rods need only slight straightening, and only on 10 to 15 per cent. of the rods is the section onto which the stopper heads are screwed, damaged sufficiently to require replacement. Consequently, metal consumption and labour costs for the manufacture and repair of the rods were reduced to a fifth or a sixth of the previous figures. Metal losses also dropped from 0.06 to 0.02 per cent. Thus the use of the cooled tubular stopper rods was both technically and economically advantageous.

On the basis of the results of the introduction of cooled stoppers, the following conclusions may be drawn.

The use of air-cooled stoppers eliminates instances of burning out of stoppers during teeming, improves the operation of the stopper, increases the working life of the stopper rods, sharply decreases the amount of straightening and repair operations on the stopper rods, and does not introduce additional difficulties in arranging the work of assembling and drying the stoppers and of carrying out teeming of the steel.

A technical and economic assessment of the use of air-cooled stoppers under the conditions in the open-hearth furnace shop of the Stalinsk Works shows that the resultant annual economy amounts to about 250,000 roubles.

[1] Denotes steel containing about 0.4 per cent. C and 1 per cent. Cr.
[2] Denotes 0.2 per cent. C steel.

HEAT TRANSFER BETWEEN METALS IN CONTACT

BASIC information has been obtained on some of the factors which affect the transfer of heat between two machined metal surfaces. The transfer of heat between solid surfaces is widespread, for example, between fuel rods and cans which are in static contact in a nuclear reactor, and between the riveted components of an aircraft subjected to aerodynamic heating. Measurements of the heat transfer between machined metal contacts have been made with brass and aluminium surfaces of four different values of roughness in contact with steel and brass surfaces of two different roughnesses. Contact pressure was varied between 14,000 and 11,000 lb./sq. in.

It was found that most of the heat was transferred by surface contact and conduction through the intervening fluid. The fluid conductance was found, as expected, to be directly proportional to the thermal conductivity of the fluid and inversely proportional to an "effective fluid film thickness"; the way in which the effective fluid film thickness depended on surface roughness was determined.

The conductance through surface contact was dependent on applied pressure, surface hardness, surface finish, and the thermal conductivities of the solids; the relation between these factors was obtained. A theoretical expression for the surface contact conductance has been developed, based on the resistance to heat flow associated with a constriction. It gave good agreement with the experimental results when the variation of metal hardness with load in the micro-hardness region was taken into account.

This work was carried out for the National Engineering Laboratory at the Imperial College of Science and Technology, University of London. Further information is given in "NEL Report Heat 182" ("Thermal and Electrical Conductance of Machined Metal Contacts," by L. C. Laming), available from the laboratory, East Kilbride, Glasgow.

Stora Kaldo Steelmaking in the US

PLAN for the $17,500,000 installation of Stora Kaldo steelmaking facilities at the Roemer Works of the United States' Sharon Steel Corporation marks the first installation of this type in the western hemisphere. Up to now the six American steel firms which have taken up the oxygen converter system have chosen the LD process.

Initially, Sharon's two 150-ton units will give it a 1,000,000-ton a year capacity. Installation of a third unit will increase capacity to 2,000,000 tons and enable the company to discard some of its less efficient open hearths.

RESEARCH ON AUTOMATION in the Belgian steel industry will be aided by financial grants from the High Authority of the European Coal and Steel Community totalling $5,000,000 in the next few years.

TRIALS WITH

The Midget Miner

in the Garw Seam

by R. WILLIAMS, M.I.Min.E.*

A brief history of attempts at power loading in the Garw Seam, using flight loading and ploughing, are given in this paper presented to the South Wales Branch of the National Association of Colliery Managers on May 10, 1960. After somewhat limited success with these two types of power loading, a Midget Miner was introduced in September, 1958. The author concludes that the Midget Miner face is the first power-loading installation in the Garw Seam where productivity results have exceeded those of conventional faces for any continuous period.

THE Garw Seam lies comformably below the Old Coal at depths varying from 60 to 90 ft. at Cwmtillery Colliery, and is the last workable seam below the Amman Marine band. This seam forms the major coal reserves of Abertillery New Mine and is being extensively worked at the north-east corner of the South Wales coalfield. Its name varies throughout the coalfield; it is called Cribbwr Fach, Crapiog Bryn, but mainly named Garw.

The usual working seam section at Cwmtillery and Rose Heyworth (whose takes mainly constitute the reserves of Abertillery New Mine) is 2 ft. 4 in. of coal, but this thickness decreased to 1 ft. 10 in. in a panel which worked 2,250 yd. north of Cwmtillery shafts. To the west, at Waun Lwyd Colliery at a distance of 4,400 yd. from Cwmtillery, the seam deteriorates to a thickness of 1 ft. 11 in. while eastwards in the Blaenavon area it averages 2 ft. 4 in. thick to the eastern outcrop. The seam again thins in a northerly direction from the Blaenavon and Big Pit colliery shafts. Fig. 1 shows the longwall faces at Cwmtillery and the variation in seam thickness.

The Midget Miner face, G9, in the Garw Seam at Abertillery New Mine is immediately overlain by a band of silty mudstone of up to 3 ft. thick. Above this is a band of quartzitic sandstone about 6 in. thick and this is succeeded by a well-bedded silty mudstone about 3½ ft. thick. Fig. 2 gives details of seam section, which is described as follows:—

(*a*) Bright-banded coal 7 in. thick with occasional pyritic nodules some 2 in. from the top.

(*b*) Middle coal of 13 in., mainly bright banded with dull bands at about 1½ in. and 4 in. from the top of the middle coal.

(*c*) Bottom coal of 9 in., of which the top 4 in. is mainly streaky bright coal and the bottom 5 in. generally inferior.

This bottom 5 in. contains several bands of carbonaceous mudstone locally termed "bunking" which adheres tenaciously to the floor. It is very hard, and conventional coal cutters are readily inclined to ride out of it into the softer coal above. This is a recognized abnormality and is catered for in the conventional colliers' seam price-list. The floor of the seam is slightly uneven presenting the appearance of corrugations of a very long pitch and below the seam is a typical ganister varying in thickness grading downwards to a shaly seat earth.

The Garw Seam has a hard texture with well-defined cleavage breaks at general intervals of 2 ft. and is one of the standard coals used for experimental purposes at CRE at Isleworth. The coal is medium to strong caking and has a volatile matter content averaging 28 per cent.

The roof lends itself to successful caving which is being practised on G9 and throughout the Garw workings. The Garw Seam in the Cwmtillery and Rose Heyworth areas is rather unique in that faults have proved to be relatively rare and are mainly in a direction of 10-30 deg. W. of N. Seam displacements by faulting in the upper seams are not always present in the Garw and are much reduced if the faults reach the Garw. However, when even minor faults do occur, they prove to be very troublesome due to the low working section.

Abertillery New Mine is an integration of Cwmtillery and Rose Heyworth collieries which will effect major economies in surface manpower and eliminate existing rope haulage and shaft winding systems which are bottlenecks. The mine will become productive during 1960.

Coal is to be brought direct from the faces to a new coal-preparation plant of 220 ton/hr. capacity, by a trunk-belt conveyor system delivering

* Deputy Area Production Manager (Operations), No. 6 Area, South-Western Divisional Coal Board.

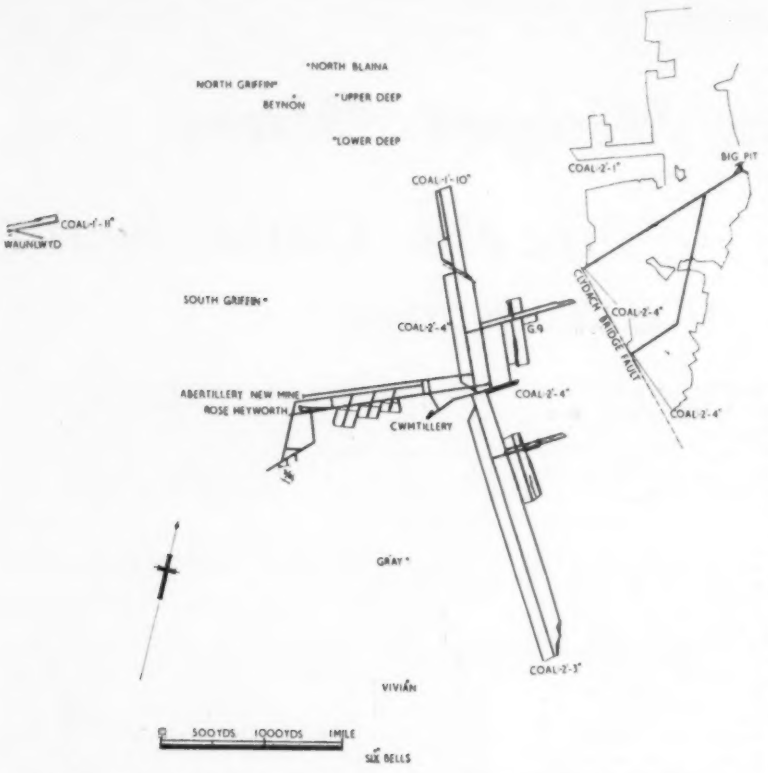

FIG. 1.—PLAN OF THE GARW SEAM WORKINGS AT ABERTILLERY NEW MINE.

on to a cable belt in a 1 in 5 cross-measure drift to the surface (Fig. 3). The designed mine output is 3,000 ton/day, all coal to be broken to minus 8-in.

The reserves of the New Mine total approximately 20,000,000 tons in seams which have all been successfully worked at Cwmtillery, Rose Heyworth, or adjacent collieries.

It will be seen from Table 1, showing the reserves, that the Garw forms approximately 60 per cent. of the total.

From Table 1 (Garw) it will be realized that to make the scheme even more fruitful than originally planned, it is essential that power loading of the thin Garw Seam should be successful so that an improvement of the present maximum face o.m.s. of 65 cwt. may be effected, a manpower shortage being anticipated.

TABLE 1.—*Reserves at Abertillery New Mine.*

Seams in descending order.	Workable thickness.	Calculated workable reserves.	Analytical data air-dried basis.		
			Ash.	Moisture.	Sulphur.
		Thousand tons.	Per cent.	Per cent.	Per cent.
Big Vein ..	3 ft. to 5 ft. 6 in.	1,024	5.5	0.8	1.06
Three-quarter	3 ft.	1,149	6.0	0.9	0.80
Top Black ..	2 ft. 9 in. to 5 ft.	1,550	4.0	0.9	0.83
Lower Black	3 ft. 9 in.	2,190	8.5	0.9	2.04
Meadow ..	2 ft. 4 in.	2,303	4.8	0.8	0.75
Garw ..	1 ft. 10 in. to 2 ft.	11,926	5.7	1.1	0.77

Selection of Power Loader

For economical working to give bulk output from a thin seam like the Garw, a power-loading machine must either be: continuous in operation giving a shift advance of at least 4½ ft. and be controlled from each end of the face if narrow webs are being cut, or be a wide buttock machine capable of cutting an optimum length of face with a machine cycle of 24 hr.

No plough installation has yet been attempted in the Garw Seam because of the heavy capital outlay required for a doubtful prospect in view of experiments that are being—and have since 1956—carried out by CRE at Isleworth. Advice has also been sought from experts on the subject and we are informed that the seam is unsuitable for a plough installation.

A paper given to the Midland Counties Institution of Engineers in December, 1957 (Trans., Vol. 118, p. 43[1]), deals with the results of ploughing experiments at Cwmtillery Colliery in the Garw Seam both in the laboratory and in the actual seam. The paper deals specifically with the Garw Seam in which it stated: "The fracture of a coal buttock of any significant burden by a single blow applied to a cutting edge necessitates an impulse far in excess of anything that has yet been generated within the body of a coal plough. The applied thrust (or in more conventional ploughing practice, the haulage force), is the impulse concerned in these tests."

Experiments with the pneumatic auto-percussive plough have also taken place (CRE Report 2017[2]), but as far as is known there is no working model available yet for thin seam operations. If such a machine on these principles can be developed, it is considered that the machine could operate in the Garw Seam.

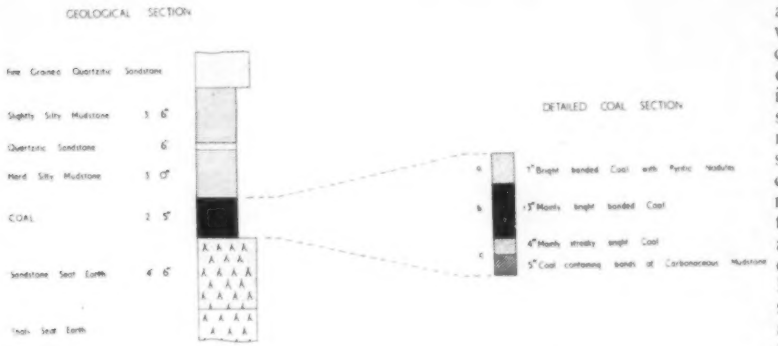

FIG. 2.—GEOLOGICAL SECTION AND A DETAILED COAL SECTION OF THE GARW SEAM.

Several types of multi-jibbed machines have been tried comprising double and triple jibs and single jibs with single and double mushrooms. Having prepared the face with these machines a flight-loading machine filling on to a bottom belt was used unsuccessfully for the following reasons:—

(1) Failure to properly prepare the coal for flight loading, blocks of hard coal continually causing the jamming of flights.

(2) The effect of jamming also produced difficulties in steering.

(3) Corrugations of the floor created problems in steering and efficient clearing of the section.

(4) The twist-type bottom loading belt failed to give adequate clearance. Bottom-loading belts now, however, are efficiently used on orthodox faces throughout the Garw workings.

Much more success is being achieved in power loading the Garw Seam since September, 1958, using a Crawley Midget Miner in conjunction with a C.5 Lohite Crawley panzer conveyor with a prop-free-front system. The remainder of this paper will deal with details of trials with this machine on the G9 face at Cwmtillery Colliery.

Description of Layout for Midget Miner

The G9 face was selected for the following reasons:—(*a*) The seam in this area is of a good consistent section; (*b*) the area is free from faulting; (*c*) the face gradient was consistent at 1 in 11 and level in direction of advance; (*d*) good trunk facilities were available, although tram clearance was inadequate until the New Abertillery Mine system becomes operative.

The panel is 150 yd. long to road centres, the tail-gate stripping the loose end of an adjacent panel worked in advance. All Garw production panels have been laid out to take advantage of the pronounced slips so that the faces can be worked "on end."

The Lohite face conveyor delivers on to a 25-h.p. gate scraper conveyor, the face conveyor being driven by a main and tail drive each of 40 h.p. and incorporating fluid couplings. The conveyor is suitable for mechanized work in a thin seam because the height of the drivehead is only 19½ in. Since the chain speed is only 109 ft./min. with a flight spacing of 36-in. centres, it was found necessary to decrease this spacing to 18 in. adequately to clear the coal produced by the Midget Miner. A similar improvement appears to have been made at New Lount Colliery of No. 7 Area, East Midlands Divisional Coal Board.

Stables are provided for turning the machine at each end of the face and experience did show that these needed to be 15 ft. long measured from the point at which the grading pan is fitted to the conveyor at each end, due to the fact that the guide bar securing the Midget Miner to the conveyor would not rise above the height of a standard pan on to the ramp pans. By using the latest type of short guide bar, however, 11-ft. turning stables are now adequate.

The overall lengths of stables are 10 yd. at the main gate to accommodate the 12-ft. road and stable cutter and 8 yd. at the tail gate to accommodate the tail drive plus the stable for the Midget miner. The depth of each stable is 11 ft. to allow for the length of the machine when being turned.

In each stable 2 ft. 6 in. of roof is ripped in advance of the panzer driveheads to allow ample clearance for the flow of coal. This extra height also facilitates servicing of the Midget Miner at the end of its run.

The main gate is a 12-ft. arched roadway with a 2-yd. pack on left-hand side and a 5-yd. pack on the right. The tail gate is an existing 9-ft. arched roadway with a 5-yd. pack on the left and a small dummy road is used behind the panzer, connected to the old road at intervals. Roadside packs are formed behind the dummy road from dirt made in ripping height over the tail drive.

It is intended, in the near future, to drive a dummy road 5 yd. long to the left of the main gate road for conveying purposes thus leaving the road free of equipment so that slushing of all rubbish can be introduced.

Face Supports

Although all conventional Garw faces are equipped with friction props, it was decided, to improve speed of operation, to use hydraulic props with riveted friction lids in conjunction with 18-in. corrugated bar section lids in G.9 face. Lids are in general use in the Garw Seam due to the strong nature of roof and restricted height and HMI have granted an exemption from the use of bars for these reasons. A line of cogs is maintained behind the

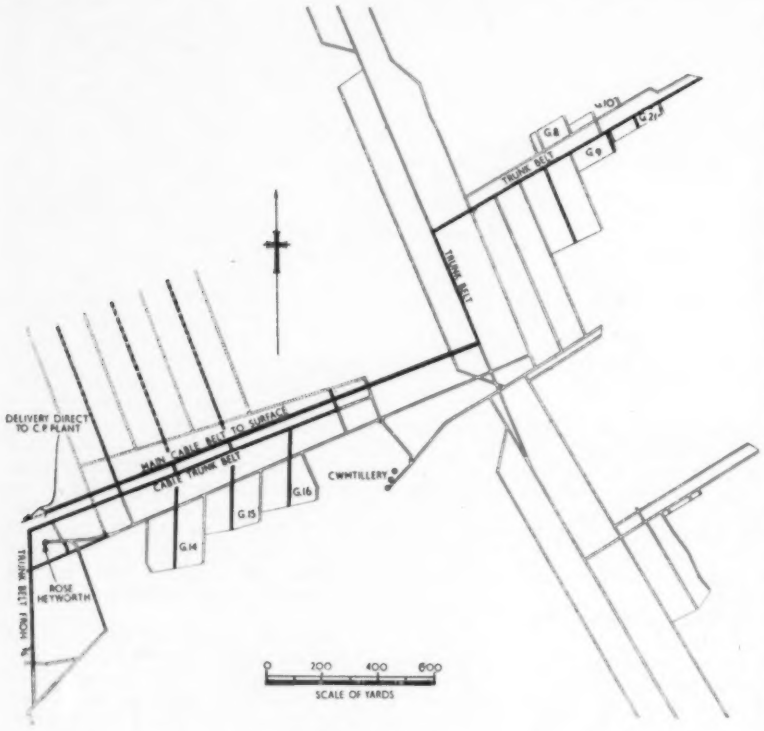

FIG. 3.—LAYOUT OF THE CONVEYING SYSTEM IN THE GARW SEAM AT ABERTILLERY COLLIERY.

last line of props for caving. Friction props could now be considered for such an installation.

The Inspectorate has authorized the system of support used subject to the following conditions:—(*a*) Distance between adjacent rows of props shall not exceed 4 ft. 6 in.; (*b*) the interval from the front row of props and face immediately after filling shall not exceed 7 ft.; (*c*) no alteration whatever is made to the overall system without consent of HMI; (*d*) props in the same row must not exceed 3 ft. 6 in. apart; (*e*) chocks shall not be more than 6 ft. apart and the maximum distance from the chocks to the coal face is 12 ft.

Cross strapping is maintained over the two drives to enable the conveyor to be pushed over under supported roof. Fig. 4 gives details of the whole of the support system during all operations.

Midget Miner and Associated Equipment

The machine, illustrated in Fig. 5, is single ended and has four boring arms spaced at approximately 76 deg. to lag each other. These operate ahead of the periphery chain which clears any uncut and unloaded coal. The chain includes flight pick boxes specially designed to ensure complete loading of coal. The Miner was driven by a BJ-D 75-h.p. standard motor and for traction used the standard BJ-D-cutter haulage-end. A later version is now driven by an AB 70-h.p. standard motor with a standard AB cutter haulage-end.

The overall length of the machine excluding guide bar is 9 ft. 3 in. with BJ-D equipment and 8 ft. 8 in. with AB equipment. The cutting head is available to give a height of cut from 22 to 30 in. and in this case the 27-in. head is used allowing a tolerance of 2 in. for variation in the seam section.

Initial experiments with the standard BJ-D haulage end were not entirely satisfactory due to haulage problems. Because AB 15 undercutters were the standard machines used throughout the colliery, it was decided to use an AB haulage-end and motor. This eased the spares position and the men are well practised in using and maintaining AB machines.

The cutting heads used have been of two types, as shown in Fig. 6. The original heads were the centre-rose type, but with two arms, one of which contained two shearer disc-type picks, while the opposite one had three picks. Trepanner-type heads have since been developed in an attempt to improve the size of the product. The first trepanner arms did not have sufficient "heel" clearance thus causing the miner to roll. The machine, from a performance point of view, proved to be much more efficient with the original cutting heads. Lately, however, modified trepanner arms have given a satisfactory performance and an improved size of coal by increasing the chain speed of the loading head from 379 to 484 ft./min.

The original haulage arrangement was the conventional short length coal cutter haul which considerably delayed the machine. Several modifications were tried to improve the control and guiding of the machine and finally a full-length rope with Macdonald winches fixed to both ends of the face conveyor proved to be the most satisfactory. A ¾-in. blue-strand continuous flexible rope is used with Trewella rope clamps to connect the main face rope to the short tension winch ropes. The original face rope is still in use.

The actual face of Garw coal is relatively soft

for the first three or four in. and thus not hard enough to guide the machine in a straight line because the pick action causes the machine to move away from the conveyor line into the face.

Several types of guide bars have been developed and finally a short type of bar with separate bars for each direction of cutting and still clipped to the panzer, has been developed and is proving satisfactory (Fig. 7).

Hydraulic jacks enable the machine to be lifted or lowered at each corner independently as a means of maintaining the correct cutting horizon. Fig. 8 shows a diagrammatic layout of the complete system. Recent improvement in design has made the system much less vulnerable and leakages in the system are now relatively rare. The hydraulic system is fully pressurised and works at 1,250 lb./sq. in.

Electrical Equipment

The supply is at 2,200 V, 3-phase, 50 cycles from an inbye substation. A transwitch unit with a capacity of 200 kVA is fitted with both primary and secondary oil-circuit breakers. The secondary output is at 565 V.

The cable from the secondary side of the transwitch unit is a 3-core, 0.1 sq. in., double-wire armoured type, at the end of which is attached a 50-yd. length of 3-core, 0.1 sq. in., type 20 pliable-wire armoured cable to facilitate advance of gate-end panels to the face.

The section switch used is a Reyrolle type C.A.3 200 amp. capacity, fitted with overcurrent and earth-leakage protection.

The gate-end switchgear is Reyrolle type G.A.1 contactor panels of 80-amp. capacity and fitted with overcurrent and earth-leakage protection and interrupted pilot control. Of the five-panel gate end switchboard, two panels are time-sequence controlled for the starting of the Crawley armoured face conveyor. Further panels control the Midget Miner and the stage loader. An additional panel is provided in case of breakdowns.

The Crawley face conveyor is fitted with a Newman 40-h.p., 1,470-r.p.m., flange-mounted motor at head and tail drive heads supplied via 5-core, 0.0225-sq. in., type 22 cable, the cable to the tail motor being laid in hangers attached to the conveyor structure. A Huwood type A56 remote start/stop switch is mounted near the head drive unit, the control cable being 3-core, 0.007 sq. in., type 61. An emergency Davis Derby stop and signal pull wire system is installed along the entire length of face.

The motor driving the Midget Miner was a 75-h.p. BJ-D similar to those fitted to the BJ-D disc shearer, except that modifications have been carried out by manufacturers to the rotor shaft to enable the motor to be adapted for use on this machine. The present AB motors have been adapted by using an extra intermediate gearbox. The trailing cable is a 5-core, 0.04-sq. in., type 7 coal-cutter cable. Cable bollards are provided in the gate road for all trailing cables.

Water for dust suppression is supplied to the face at a pressure of 280 lb./sq. in. from the 3-in. main column. Connecting lengths of ¾-in. wire braided hose carry the water to the machine where it can be controlled by the operator by a suitable valve. Wire braided ½-in. hose carries

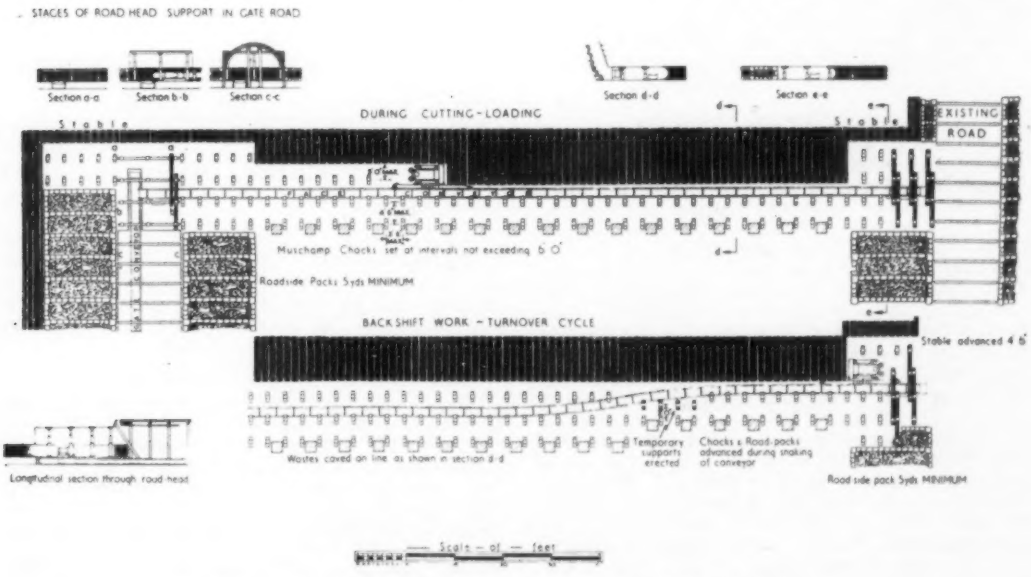
STAGES OF ROAD HEAD SUPPORT IN GATE ROAD
Section a-a
Section b-b
Section c-c
Section d-d
Section e-e
DURING CUTTING-LOADING
Stable
EXISTING ROAD
Muschamp Chocks set at intervals not exceeding 6 0"
Roadside Packs 3yds MINIMUM
BACK SHIFT WORK - TURNOVER CYCLE
Stable advanced 4 6"
Temporary supports erected
Chocks & Road-packs advanced during shaking of conveyor
Wastes caved on line as shown in section d-d
Road side pack 3yds MINIMUM
Longitudinal section through road head
Scale — of — feet

FIG. 4.—SYSTEM OF FACE SUPPORT AT THE MIDGET MINER FACE.

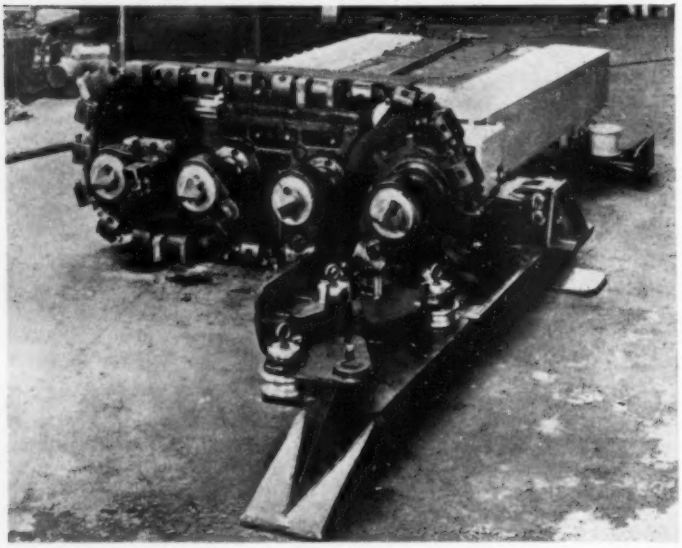

FIG. 5.—MODIFIED MIDGET MINER WITH THE SHORT GUIDE BAR.

the water along the top of the machine to a ½-in. pipe across the width of the cutter head gearbox, having four spray-fitted outlets. These sprays throw the water into the cuttings in a fine mist spray.

In addition, a jet is positioned at the side of the machine against the coal to direct water on to the picks of the periphery chain. This arrangement has proved quite satisfactory and an average of thermal-precipitator samples taken shows a mean concentration of 350 particles/c.c.

Description of Operations

The machine commences the cutting operation from the stable and as the machine advances temporary props are set behind the machine at 3-ft. intervals 3 ft. from the face. The stables are worked on the same shift with the coal prepared by conventional means, the undercutting being done by the stable colliers.

Attempts have been made with pulsed-infusion shotfiring in this seam to prepare the stables, but have not been very successful because the coal does not part easily from the floor. A summary of a series of time studies taken during eight cutting shifts with the original arms show that the average cutting time per cut to be 167.73 min. at an average cutting and loading speed of 2.29 ft./min., which means that there is a possibility of double-shift working because turning and caving could be carried out in the remaining part of the shift. From recent time studies (with the trepanner arms) the average cutting time is 1.61 ft./min. and average time per full cut is 230 min., which well confirms the feasibility of double-shift working.

Turning the Miner at the end of the cut is now much simplified with the short guide bar and takes an average of 109 min. A typical time study of the machine turning operation is given in Table 2.

TABLE 2.—*Time Study Details of Turning the Machine in the Main Stable.*

Operations.	Min.
Change position of grab to pull machine to stable	10.85
Move machine to stable	0.30
Remove guide bar and rope, etc.	16.04
Prepare cutter to turn Midget and attach rope	24.23
Turn Midget Miner	8.86
Alter props	6.82
Adjust anchor prop	0.59
Stell Midget	10.23
Replace guide bar, etc.	18.45
Total	96.37

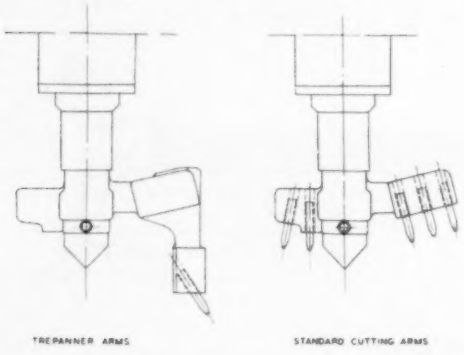

FIG. 6.—ARRANGEMENT OF TYPES OF CUTTING ARMS USED ON THE MIDGET MINER FACE.

Having dispensed with the laborious job of taking off and refitting the long and heavy guide bars, turning time has been reduced by at least an hour. The new guide bar weighs 5½ cwt. compared with the previous one weighing 11 cwt.

Conveyor Moving

In snaking the conveyor and the altering and resetting supports attempts were originally made to snake the conveyor during cutting and filling operations, but it was found that because of moving the conveyor forward 4 ft. 6 in. the rope crossed the conveyor for a length behind the Miner and impeded operations when cutting away from the loading gate.

This created the following difficulties:—(*a*) The flow of coal was interrupted and the coal forced off the conveyor; (*b*) the rope in tension tended

to bind on the flights of the conveyor with a braking effect increasing the load on the chain thus causing overload; (c) with heavy load on the partly snaked conveyor chain trouble was experienced. It was finally decided that the snaking operation should take place on the succeeding shift or on the same shift after loading had been completed utilizing the same budgeted labour.

The conveyor is moved over by hand jacks worked on a Sylvester principle. During the snaking operation the conveyor is pushed over against the temporary face prop, another temporary prop is set against the gob side of the conveyor, and the face prop is removed and conveyor pushed forward to its final position. Finally, the permanent gob side support is erected against the gob side of the panzer. Hydraulic jacks are being considered so that a saving in manpower can be effected.

Caving takes place after each section of the conveyor has been fully pushed over and has proved to be a highly successful form of roof control.

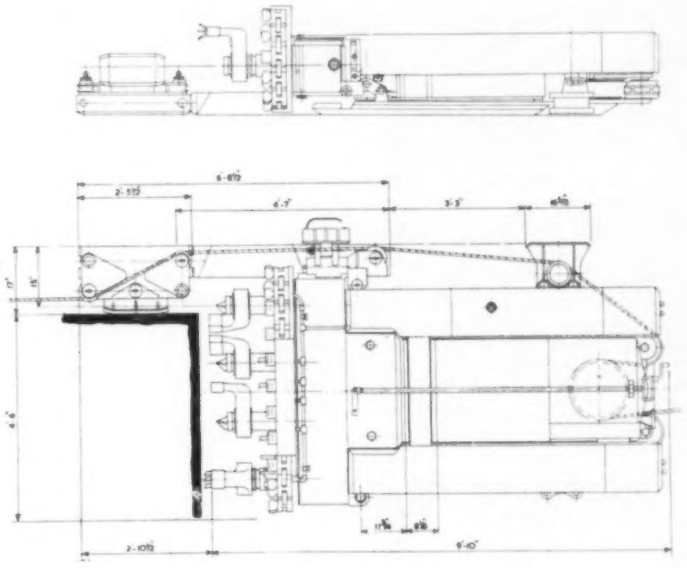

FIG. 7.—GENERAL ARRANGEMENT OF THE MIDGET MINER MARK IV WITH AN AB HAULAGE UNIT.

Manpower

Normal manning which has been proved necessary for a 24-hr. cycle for the machine is shown in Table 3.

TABLE 3.—*Normal Manning for a 24-hr. cycle.*

Occupation.	No. of men.	Description of work.
Operator and assistant	2	Cutting and turning machine.
Proppers	2	Move props over from gob side to face, set face props and clean spillage.
Stableman	4	Advancing both stables.
Conveyor movers ..	6	Pushing over with hand mechanical jacks and withdrawing and resetting supports.
Caving	4	Withdrawing and resetting one row of cogs and Dowty props.
Gate road	7	Rippings and setting 12-ft. steel arches.
Tail gate	2	Making dummy road and connecting airways with old roadway.
Conveyor operator ..	1	
Fitter	1	Maintenance.
Total	29	

However, due to the experimental nature of the installation and the inadequate clearance of the present tram circuit it was decided to arrange trials on 48- and 72-hr. cycles, although 24-hr. cycles have been arranged at certain times when difficulties arose on other faces. This practice was considered necessary so as to prove the reliability of the machines to operate a 24-hr. cycle once facilities become available at Abertillery New Mine.

Since it is further intended to slusher pack the gate road (tail-gate slushing is standard practice throughout Garw workings) and together with hydraulic jacking a total of six men can again be saved.

Output and Results

The output for the Midget Miner on a 72-hr. cycle was 3,728 tons over the 13-week period May 16 to September 5, 1959, excluding holiday weeks, with an o.m.s. of 74.5 cwt. This o.m.s. was achieved, although several breakdowns occurred during the period. The number of days worked by the machine during the period was 34.

Since modification the Miner has worked more successfully. From February 6 to March 19, 1960, the miner loaded 1,632 tons of coal with a face o.m.s. of 96.6 cwt. for 18 machine shifts. The immediate potential of the Midget Miner is five strips per week at 152 ton/strip and manpower of 29 per day. The saleable o.m.s. would be 105 cwt./manshift until further manpower savings can be effected.

The output of the conventional faces in the Garw Seam over the first three months of 1960 was 3,340 ton/week with an average face o.m.s. of 56.8 cwt. Therefore, the actual performance of the Midget Miner, even on a reduced cycle and during an experimental period, compares very favourably with the conventional faces.

Table 4 gives an average analysis of washed coal from the conventional faces adjacent to the

Midget Miner face compared to similar samples from G.9 Midget Miner face.

TABLE 4.—*Average Analysis of Washed Coal Sizes from the Midget Miner Face and a Conventional Face.*

Nominal size.	Percentage of sample in size fractions.		Variation, per cent.
	Conventional.	Midget Miner.	
+ 6 in.	26.0	3.5	−22.5
6 in.–4 in.	9.7	3.8	− 5.9
4 in.–2 in.	9.6	7.4	− 2.2
2 in.–1 in.	6.9	3.9	− 3.0
1 in.– ½ in.	7.1	7.3	+ 0.2
½ in.– ¼ in. ..	9.9	22.3	+12.4
¼ in.–30 BSS ..	14.3	31.0	+16.7
Under 30 BSS ..	5.8	12.1	+ 6.3

The results shown in Table 4 were obtained with the original cutting arms. Another series of samples, shown in Table 5, have been taken since modification with the new trepanner arms. The results are compared with the original arms.

TABLE 5.—*Sizing Results comparing the Trepanner Arms with the Original Arms.*

Screen size.	Average of three samples, Dec., 1958 (original arms), per cent.	Average of two samples, March, 1960 (trepanner arms), per cent.	Variation, per cent.
Above 6 in. ..	3.8	2.0	− 1.8
6 in.–4 in.	4.2	1.5	− 2.7
4 in.–2 in.	8.1	8.2	+ 0.1
2 in.–1 in.	4.4	7.1	+ 2.7
1 in.– ½ in.	8.3	12.7	+ 4.4
½ in.– ¼ in. ..	24.8	30.4	+ 5.6
¼ in.–30 BSS ..	33.5	25.8	+ 7.7
− 30 BSS	12.9	12.3	− 0.6
Total	100	100	—
SUMMARY			
Above 2 in. ..	16.1	11.7	− 4.4
2 in.–1 in.	4.4	7.1	+ 2.7
1 in.– ½ in.	33.1	43.1	+10.0
Less than ½ in. ..	46.4	38.1 ..	− 8.3

Table 6 shows the installation costs which are additional to a conventional Garw face. Therefore, coal cutters, gate conveyors, etc., are not included.

TABLE 6.—*Installations Costs of a Midget Miner Face compared with a Conventional Face.*

Midget Miner face.	£	Conventional face.	£
Lohite conveyor ..	4,950	Face belt	1,580
Midget Miner	5,500		
Dowty props	5,200	Union props ..	3,200
Additional plant:			
Panels	300		
Cable	350		
Totals	16,300		4,780

The extra initial cost of the Midget Miner face was £11,520. On a regular 24-hr. cycle this would cost an extra 9d./ton depreciation compared with conventional faces. Extra power cost for the installation is approximately 2¼d./ton.

It is expected to increase the Garw face saleable o.m.s. from 65 cwt. (conventional maximum) to 105 cwt. by using the Midget Miner and to further increase to 132 cwt. with further mechanization. Due to the increase of 33 per cent. in the sized coals below 1 in., further trials must take place to increases sizes, otherwise there must be a limit to the number of Midget Miners that can be worked before proceeds are affected.

The Midget Miner installation is the first power-loading installation in the Garw Seam where the results in o.m.s. have exceeded those of conventional units for any continuous period. There is ample evidence that the o.m.s. mentioned in this paper will be achieved once satisfactory clearance facilities are completed.

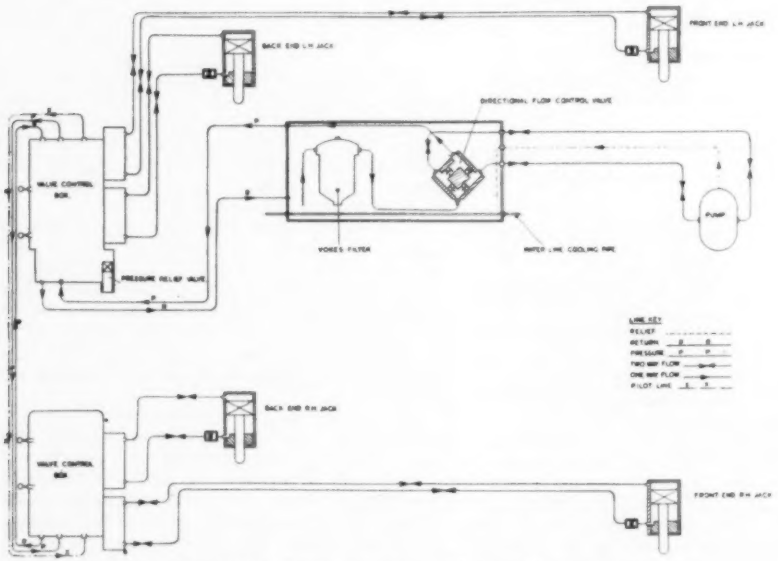

FIG. 8.—HYDRAULIC LAYOUT FOR THE MIDGET MINER ON FACE.

Recent modifications include an improvement in hydraulic system, structural modifications to the machine body, the use of short guide bar (with one trailing behind machine) and the adaption of AB haulage-end and motor. These changes have improved the reliability of the machine and breakdowns in recent months have been negligible.

Crawley Industrial Products, Limited, is further developing the Midget Miner from Mark IV to Mark V. This

move is mainly for the following reasons:—

(*a*) To reduce the minimum seam application from 22 in. to 18 in.

(*b*) To achieve greater speeds by increasing the h.p. available for cutting and haulage.

(*c*) To improve reliability and by adopting a haulage arrangement sited outbye the face.

(*d*) To improve steering through the face.

(*e*) To reduce overall length of the machine.

(*f*) To reduce hydraulic working pressure and fit a fixed pressure unloader.

It is felt, however, that the Mark IV machine is satisfactory and better suited to the Garw Seam.

The author wishes to express his thanks to Mr. Lister Walker, Area general manager, No. 6 Area, South-Western Divisional Coal Board, for permission to publish this paper. He also wishes to thank Mr. A. E. Hiscox, No. 6 Area production manager, Crawley Industrial Products, Limited, for its advice and encouragement, the Abertillery group staff, and Mr. A. V. Broughton (now manager of Llanhilleth Colliery), for their assistance in preparing this paper. He is grateful to Mr. A. E. Huxley, manager, Cwmtillery Colliery, and the officials and workmen of the colliery for their wholeheated co-operation during the experimental period. The opinions expressed are those of the author and not necessarily those of the National Coal Board.

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ANTHRACITE PREPARATION PROCESS

COMPLETE automation of heavy media processes in coal and iron ore preparation is reported in an installation in the Pennsylvania anthracite industry. A closed loop control system by the Underkoffler Coal Service Company, of Lykens, has substantially lowered costs by permitting the preparation of coal with uniform ash content. It also allows recovery of low-ash coal previously discarded as waste. The scheme is a collaborative development of Wilmot Engineering Company, Industrial Nucleonics Corporation, and the American associates of Honeywell Controls, Limited, Greenford (Middx).

At the Underkoffler plant, which processes 600 tons of anthracite per day, control is interlocked to a series of valves and mechanical devices to maintain specific gravity of the water-magnetite medium in the separatory system at optimum value and to add magnetite automatically as needed. Control of gravity is held within $\pm$ 0.003.

Units used are an electronic circular chart recorder, an electric proportioning unit, a graduated motor, and an AccuRay density measuring unit employing gamma radiation.

The Wilmot heavy media system is a double-hulled vessel with a three-compartment sump. Fast-draining medium underflowing the lead end of the vibrating screen is sluiced directly to the main medium sump for recirculation to the media vessel. Magnetite remaining is spray-washed into a washing hopper as the coal moves along the vibrating screen. This is pumped to a magnetic separator, which collects and concentrates the magnetite, passes it through a demagnetizing coil, and returns it to the main medium sump. Magnetite is further recovered by spray washing the discharge end of the vibrator; this solution is recovered in a counter-flow hopper and recirculated through sprays over coal above the washings hopper. Magnetite recovery is said to be so complete that only 0.4 lb./ton of raw coal feed is required.

The AccuRay unit, which operates on the principle of radiation absorption being proportional to the mass it penetrates, measures to within 0.001 the specific gravity, 1.70, of the medium as it enters the heavy media vessel. The radiation source is mounted on one side of a short section of pipe ahead of the media vessel. The radiation detector is mounted on the opposite side of the pipe.

The electrical signal from the detector is amplified and printed on the electronic recorder. Depending upon gravity, the electric proportioning unit controls either of two motorized valves: one to bleed the circulating medium to a magnetic separator for densification, the other to add fresh water to dilute the medium. The unit also controls a graduated motor which, in turn, operates a rate-adjusting rheostat on the magnetite feeder.

In addition to the main controls, the system also includes an AccuRay level detector on the main sump from which the medium is circulated and a recording-controlling ammeter on the coal feed to the heavy media vessel. Off-normal sump level automatically adds water to the sump, if density is too high, or by-passes medium to the magnetic separator on a low reading. The ammeter measures current drawn by the motor driving the coal feed, shutting down the magnetite feeder if coal feed falls below a prescribed minimum.

Before installation of the automated heavy media vessel, the Underkoffler Company processed 400 tons of coal per day with jigs using water as the separatory medium. Where ash content of the prepared coal previously ranged from 12 to 16 per cent., it now averages 10 to 11 per cent.

PIG-IRON AND STEEL PRODUCTION

IN the following United Kingdom pig-iron and steel statistics, issued jointly by the Iron and Steel Board and the British Iron and Steel Federation, Table 1 gives the production of pig-iron and ferro-alloys and the number of furnaces in blast in April. Table 2 gives the production of steel ingots and castings in April and Table 3 gives details of finished steel in March. Activities of the industry are summarized in Table 4.

TABLE 1.—*Weekly Average Production of Pig-iron and Ferro-alloys in April*, 1961. (*Thousands of Tons.*)

District.	Furnaces in blast.	Hematite.	Basic.	Foundry and forge.	Ferro-alloys.	Total.
Derbys, Leics, Notts, Northants, and Essex	20	—	27.4	19.8	—	47.2
Lancs (excl. N.-W. Coast), Denbighs, Flints, and Ches	8	—	24.3	—	1.9	26.2
Yorkshire (excl. N.-E. Coast and Sheffield)	—	—	—	—	—	—
Lincolnshire	10	—	48.2	—	—	48.2
North-East Coast	16	2.5	63.8	—	—	66.3
Scotland	7	1.1	25.4	1.2	—	27.7
Staffs, Shrops, Worcs, and Warwicks	5	—	10.7	1.0	—	11.7
South Wales and Monmouthshire	10	2.6	56.3	1.3	—	60.2
Sheffield	2	—	3.5	—	—	3.5
North-West Coast	8	15.1	—	1.0	1.3	17.4
Total	86	21.3	259.6	24.3	3.2	308.4
March, 1961*	86	23.9	262.6	23.6	3.4	313.5
April, 1960	86	26.4	252.5	28.0	3.7	310.6

TABLE 3.—*Weekly Average Deliveries of New Non-alloy and Alloy Finished Steel.* (*Thousands of Tons.*)

Product.	1959.	1960.	1960.	1961.	
			March.*	Feb.	March.*
Non-alloy Steel:					
Ingots, blooms, billets, and slabs‡	5.1	5.6	5.9	6.7	6.8
Heavy rails	6.8	8.7	10.0	9.6	9.2
Sleepers	0.6	0.8	0.5	1.3	1.0
Fishplates and soleplates	0.4	0.6	0.6	0.8	0.7
Plates, 3 mm. thick and over:					
(i) Over ⅜ in. thick	24.8	30.9	31.3	39.3	39.0
(ii) Under ⅜ in.	18.3	22.0	23.2	25.2	24.3
Other heavy prods.	41.2	53.1	56.3	57.7	60.3
Ferro-concrete bars	9.6	12.0	12.7	12.8	14.6
Wire rods	23.5	28.6	29.9	28.3	27.7
Arches, etc.	7.8	7.9	8.5	8.1	7.4
Other light sections	33.0	41.3	45.6	46.2	40.8
Bright steel bars	7.6	9.7	10.3	9.3	9.5
Hot-rolled strip	27.4	33.1	35.3	29.4	28.2
Cold-rolled strip	8.0	10.0	10.6	9.6	9.1
Sheets, incl. coated:					
(i) Hot rolled	11.8	12.9	13.9	11.4	11.2
(ii) Cold reduced	35.2	40.6	43.5	37.7	36.6
Tinplate:					
(i) Hot dipped	7.7	8.0	9.1	6.5	5.8
(ii) Electrolytic	13.2	14.4	15.6	14.9	15.2
Blackplate	0.7	0.9	1.0	0.8	0.7
Tubes up to 16 in.	20.6	23.8	24.5	21.8	22.6
Tube fittings, etc.	0.4	0.4	0.4	0.4	0.4
Tyres, wheels, and axles	2.4	2.4	2.8	2.6	2.3
Forgings (excl. drop)	2.1	2.2	2.2	2.5	2.2
Steel castings	3.6	4.3	4.3	4.7	4.8
Tool steel	0.2	0.2	0.2	0.2	0.3
Total	312.0	374.4	398.2	387.8	380.7
Alloy steel	18.2	22.5	23.2	23.4	23.1
Total deliveries from UK production†	330.2	396.9	421.4	411.2	403.8
Add: Imported finished steel	7.1	19.1	15.2	7.1	5.8
	337.3	416.0	436.6	418.3	409.6
Deduct: Intra-industry conversion§	47.6	56.4	61.4	54.2	53.9
Total new material	289.7	359.6	375.2	364.1	355.7

† Includes finished steel made from imported ingots and semis.
‡ Other than for conversion into any other form of steel listed.
§ Material for conversion into other products also listed in this table.

TABLE 2. *Weekly Average Production of Steel Ingots and Castings in April*, 1961. (*Thousands of Tons.*)

District.	Open-hearth.		Bessemer and LD.	Electric.	All other.	Total.		Total ingots and castings.
	Acid.	Basic.				Ingots.	Steel for castings.	
Derbys, Leics, Notts, Northants, and Essex	—	3.4	15.0 (basic)	2.7	0.1	19.7	1.5	21.2
Lancs (excl. N.-W. Coast), Denbighs, Flints, and Ches	1.5	38.2	—	5.4	0.4	44.1	1.4	44.2
Yorkshire (excl. N.-E. Coast and Sheffield)								1.3
Lincolnshire	—	51.6	—	—	0.1	51.6	0.1	51.7
North-East Coast	0.8	96.2	—	1.8	0.4	97.1	2.1	99.2
Scotland	1.2	47.1	—	4.2	—	50.2	2.3	52.5
Staffs, Shrops, Worcs, and Warwicks	—	27.0	—	4.7	0.7	30.6	1.8	32.4
South Wales and Monmouthshire	1.3	84.0	19.8 (basic)	0.7	0.1	105.5	0.4	105.9
Sheffield (incl. small tonnage in Manchester)	7.0	37.4	—	12.9	0.3	55.8	1.8	57.6
North-West Coast	—	—	4.9 (acid)	0.7	—	5.5	0.1	5.6
Total	11.8	384.9	39.7	33.1	2.1	460.1	11.5	471.6
March, 1961*	12.7	382.5	38.5	34.9	2.4	458.5	12.5	471.0
April, 1960	11.4	394.9	37.7	32.1	2.0	467.5	10.6	478.1

TABLE 4.—*Iron and Steel Price Index and General Summary of Pig-iron and Steel Production.* (*Weekly Average in Thousands of Tons.*)

Period.	B.o.T. Price Index, 1938 = 100.			Iron-ore output.	Imported ore used.	Coke sent to blast furnaces.	Pig-iron, ferro-alloys prod.	Scrap used in steel prod.	Steel (incl. alloy).			
	Iron and steel.	Coal.††	Basic materials§						Imports.†	Prod. ingots, castings.	Delivrs. finished steel.	Stocks.‡
1959	340	496	477	286	244	210	242	208	7	388	291	2,244
1960	339	505	482	329	319	264	303	243	24	467	361	2,702
1961—Jan.	339	538	472	351	327	272	308	248	14	478	364	2,739
Feb.	339	538	476	354	325	265	302	254	11	485	365	2,783
Mar.*	339	538	480	351	322	264	313	248	11	471	356	2,779
April	339	538	480	313	322	261	308	244	6	472	357	2,744

* Months contain five weeks, all tables.
† Weekly average of calendar month.
‡ Stocks, ingots, semi-finished and finished steel, at the end of the years and months shown.
†† The index for coal is now based on prices ruling on the last day of each month.
§ Used in non-food manufacturing industries.

CONSTRUCTION EQUIPMENT EXHIBITION

Big Display at Crystal Palace

The International Construction Equipment Exhibition, held at the Crystal Palace, London, throughout the current week, provided perhaps the most comprehensive display for the building and civil engineering industries ever assembled. Equipment on display ranged from the smallest hand mechanical power tools to the largest earthmoving and roadmaking machinery. Over 170 exhibitors took part and more than 50 companies from Belgium, France, Holland, Italy, Sweden, Switzerland, the US, and West Germany were represented.

CHOICE of Crystal Palace as the site for the exhibition, the first to be held there for 25 years, was influenced by the need to make it truly international. Production in the construction equipment industry has increased to such an extent over the last 15 years that the annual value now exceeds £100,000,000, 50 per cent. of which is exported.

Because of this and the accompanying growth in product size the need for an exhibition of this type, where the largest equipment can be exhibited and demonstrated, was long overdue. Extensive arrangements were made for the reception of oversea visitors.

Including the area formerly occupied by the 1851 Exhibition Palace and the terraced gardens designed by Sir Joseph Paxton, the total area of the display area was well over 250,000 sq. ft., an additional 180,000 sq. ft. being specially reserved for demonstrating machinery and equipment under normal working conditions. A feature of the exhibition was a replica of the 1851 Exhibition Palace, providing a startling reminder of the original and a fitting foretaste of things to come. Reference to some of the exhibits is made below.

The Autopactor's Début

The Autopactor, one of a range of pneumatic-tyred soil compactors marketed by ARMSTRONG WHITWORTH (METAL INDUSTRIES), LIMITED, was demonstrated for the first time at the exhibition. Advantage of this new compactor is that it allows much higher soil compaction specifications to be met.

Last-minute addition to the ATLAS COPCO (GREAT BRITAIN), LIMITED, display of portable air compressors, rock drills, shovel loaders, and stationary air compressors was an air-cooled air compressor delivering 140 c.f.m. on a tractor, driving from the tractor's power take-off. Known as the Roughrider, it carries a 2-cylinder reciprocating compressor and, as cylinders, valves, pistons, and other wearing parts are interchangeable, only small stocks of spares are necessary.

A comprehensive cross-section of roadmaking, earthmoving, and quarrying equipment was shown by the AVELING-BARFORD group of companies. A reminder of the start of mechanized roadmaking was an 80-year-old steamroller built by Thomas Aveling in 1882.

BARBER-GREEN OLDING & COMPANY, LIMITED, showed Rolls-Royce diesel engines and Yale Trojan tractor shovels, while demonstrated on the proving ground were a Euclid TS-14 twin-powered scraper and the Euclid C-6 crawler tractor, the exhibitors being JOHN BLACKWOOD HODGE & COMPANY, LIMITED. Occupying one of the largest sites in the exhibition—5,000 sq. ft.—BLAW KNOX, LIMITED, showed several new or improved products for the first time.

The first public appearance of the Boughton side-tip bucket fitted to an International Harvester crawler tractor was made on the stand of T. T. BOUGHTON & SONS, LIMITED. The side discharge of the bucket obviates much of the need to slew the machine, thus considerably increasing the life of the tractor parts. Visitors to the E. BOYDELL & COMPANY, LIMITED, stand were able to see the new Winget Muir-Hill 4SR 30-cwt. rear-wheel drive Dumper making its first appearance. Payloads of up to 20,000 lb. with reduced horsepower are obtained by means of the Camill dump truck. The machine can operate in soft ground conditions and it has the ability to extricate itself when bogged down.

BRAY CONSTRUCTION EQUIPMENT, LIMITED, exhibited a representative range of Brayloaders and tractor shovels. The stand of BRITISH ROPES, LIMITED, included a display panel illustrating the successive stages of manufacture of the Superloop mechanical splice. A new type of steel sleeve, much slimmer than previous examples, produces

what the company claims to be a safer splice giving a true centre pull on the sling.

DAVID BROWN CONSTRUCTION EQUIPMENT, LIMITED, exhibited a range of industrial wheeled and crawler tractors with ancillary equipment. Representative of the David Brown Taskmaster industrial haulage tractors is the 950 Turbo Shunter, a 42.5-b.h.p. diesel-powered machine. Several new Caterpillar machines were shown for the first time by the CATERPILLAR TRACTOR COMPANY, LIMITED. They included the D9G tractor and the 619C tractor-scraper.

GEORGE COHEN SONS & COMPANY, LIMITED, featured its Pingon tower cranes incorporating a new erection system which cuts erection time by up to 50 per cent., and the Jones rough terrain crane mounted on large-diameter tyres and specially designed for use in poor ground. Angledozers, tip shovels, and tractor shovels were the specialities of the J. I. CASE COMPANY, LIMITED. All Case crawler tractors are equipped with the Terramatic drive, a transmission giving completely independent control to both tracks resulting in exceptional manœuvrability and work output. Main exhibit on the R. CRIPPS & COMPANY, LIMITED, site was the Scammel Himalayan dump truck, powered from the new Leyland P.680 diesel engine.

Drilling equipment and portable compressors were displayed by the CONSOLIDATED PNEUMATIC TOOL COMPANY, LIMITED. The range extends from a miniature rock drill only 7½ lb. in weight to the Model 65W giant truck-mounted Reichdrill for 6-in. dia. deep holes in hard rock. Drills, air compressors, jackhammers, grinders, diggers, sump pumps, chippers, and scalers were among the exhibits shown by the INGERSOLL-RAND COMPANY, LIMITED.

Two New Items

JOY-SULLIVAN, LIMITED, displayed a selection of products from its range of air compressors and rock-drilling equipment. Two of the exhibits made their first show at this exhibition—a completely new design of rotary vane portable air compressor which has a capacity of 260 cu. ft./min. free air delivered at 100 lb./sq. in., and the Joy TDM Tracdrill, a self-propelled crawler track-mounted carrier fitted with a dual rotation drill of 4½-in. bore.

Two new diesel engines—107 and 193 b.h.p.—for industrial use, sectioned gearboxes, torque converters, and a fluid friction clutch were among exhibits from LEYLAND MOTORS, LIMITED. Four other diesels range from 91 to 222 b.h.p.

The new 27-ton truck-mounted crane, exhibited by PRIESTMAN BROS., LIMITED, was on view for the first time. Superstructure is powered with a 75-b.h.p. Dorman 4LB, 4-cylinder engine running at 1,600 r.p.m. The makers claim that maximum load of 60,000 lb. lifted at maximum speed of 16 ft./min. on eight "falls" of rope at 12 ft. radius compares more than favourably with those of bigger and more costly units.

MICHIGAN (GREAT BRITAIN), LIMITED, showed a wide range of rubber-tyred earthmoving and construction equipment, including tractor shovels, pipe handler, and tractor dozers. Special features include high-production speed and manœuvrability combined with rugged strength.

MARSHALL SONS & COMPANY, LIMITED, and JOHN FOWLER & COMPANY (LEEDS), LIMITED, showed the new Road-Marshall Highwayman Mark 2 diesel roller with hydrostatic transmission and fitted with hydraulic scarifier, together with a wide range of road rollers, crawler tractors, and ancillary equipment.

The WS range of lightning crusher shown by the PATENT LIGHTNING CRUSHER COMPANY, LIMITED, deals effectively with wet and sticky materials (chalk, clay, wet coal, etc.)—any material that becomes sticky with an increasing moisture content. Crushers embody certain novel features, the shape of the casing and hammers being the principal factors in the crushing operation.

Over 40 exhibits, several on show for the first time, were brought to Crystal Palace by PEGSON, LIMITED. Principal exhibit was a Pegson Wibau W5 coating plant, which was displayed, in its entirety, for the first time at any British exhibition.

A range of oil hydraulic equipment for mobile and construction machinery, shown by STEIN ATKINSON VICKERS HYDRAULICS, LIMITED, included high-performance valve pumps for 2,000 lb./sq. in. and 2,000 r.p.m. duty, multiple valves, vane motors, complete power steering systems, and cylinders. International Harvester earthmoving equipment, built in Great Britain, was shown by SAVILLE (TRACTORS), LIMITED, adjoining the International Harvester stand, where British and American machines were displayed. Demonstrated was the exclusive use of the Drott hydraulic system and mechanical design for Dozer shovels with special 4-in-1 bucket.

Cranes and excavators of all descriptions were shown by THOMAS SMITH & SONS (RODLEY), LIMITED, a member of the Thos. W. Ward, Limited, group. A truck-mounted crane has a lifting capacity of 50,000 lb. when fitted with basic 30-ft. boom. STEEL & COMPANY, LIMITED, and three subsidiary companies—Steels Engineering Products, Limited, R. H. Neal & Company, Limited, and F. Taylor & Sons (Manchester), Limited—showed a wide range of exhibits, including Taylor-Jumbo Series 50 mobile crane with a lifting capacity of 4 tons, truck and self-propelled cranes, giant diesel-electric crane (claimed to be the largest in the world), two versions of the Neal-Unit 1620 excavator, and a new earth borer. Shown by TUNNY CRANES, LIMITED, was a portable version of 2-ton crane with new hydraulically operated grab of ¼ cu. yd. capacity.

Ross air-control valves, Bull pneumatic cylinders, Master pneumatic air line equipment, and Wellman-Bretby flexible seal door were among the exhibits shown by the WELLMAN SMITH OWEN ENGINEERING CORPORATION, LIMITED. The flexible steel door is a new type of door developed by the National Coal Board for use on coal and slurry bunkers; the door utilizes standard conveyor belting as the sealing medium and, because of its non-jamming characteristics, is ideally suited to operation by pneumatic power.

Safety in Coal Mines

THE NORTHUMBERLAND AND CUMBERLAND DIVISION IN 1960

IN the course of his report for 1960 under the Mines and Quarries Act, 1954, on the Northumberland and Cumberland Division of the Mines Inspectorate (HMSO, price 2s. 6d.), Mr. H. F. Wilson, HM Divisional Inspector, points out that owing to the general recession in the coal-mining industry the National Coal Board stopped production at five mines; other mines were cut back to single-shift working or had their output reduced by the stoppage of the low quality seams.

Output increased at the reorganized mines, but the overall result was a reduction of about 14,000 tons per week. Normal working has been maintained and at the end of the year the stocks of coal on the ground were somewhat reduced.

More Power Loaders

Progress with reconstruction and reorganization continues. The number of power loaders in use is steadily increasing. They are of various types and most of them are used in conjunction with armoured conveyors. Nearly a third of the divisional output is now obtained by power loaders.

The principle of face mechanization has been extended beyond power loading to power operation of the supports system in an increasing number of cases. At the end of the year, states the Inspector, 24 faces in the division were equipped with self-advancing power-operated supports. Some of these installations have been successful, but others have given trouble. Investigation showed that in some of these cases the supports were not working properly either because they were not being used in the way the designers intended or because the mechanism had not stood up to local conditions, with the result that the supports which should have been repaired or withdrawn continued in use in an unsatisfactory condition.

The very high pressures used and the precision engineering standards of the component parts require the very highest standard of maintenance. In addition, hydraulic hose lines must be adequately protected and must be laid down so that they are not strained when the pressure is applied and they take up their natural position. The proper operation of these supports requires the training of all those who are to supervise, operate, and maintain them, but the need for thoroughness and attention to detail in this training has not always been appreciated.

Table 1 gives a summary of the number of persons killed or seriously injured in coal mines during 1960 and a comparison with the averages for the preceding three years, while Table 2 shows the incidence of the accidents in the two districts forming the division.

TABLE 1.—*Total Persons Killed or Seriously Injured at Coal Mines Working Under the Mines and Quarries Act, 1954, During the Year 1960 in the Northumberland and Cumberland Division.*

	Killed.		Seriously injured.	
	1960.	Average 1957-59.	1960.	Average 1957-59.
Falls of ground				
(*a*) At the face ..	10	6.7	53	48.6
(*b*) On roadways ..	—	2.3	4	3.0
Haulage and transport	4	4.3	26	31.0
Machinery	2	0.3	7	2.7
Other causes	4	2.0	10	9.3
Total underground ..	20	15.6	100	94.6
,, surface ..	1	1.7	10	10.0
Total	21	17.3	110	104.6

Accidents from Falls of Ground

Commenting on accidents from falls of ground, representing more than half the fatalities, the Inspector states that a large proportion of these accidents was considered to be avoidable. This points to the need for more care and attention being given to three things, namely:—(i) the identification of insecure roof and side with early consequent action either to secure it or take it down; (ii) the setting of supports tightly and securely at the earliest possible moment; and (iii) the detailed covering by the manager of withdrawal operations in his support rules and their strict application in practice.

Maintenance of Machinery

There has been some improvement in the suspension and treatment of cables, but in too many cases the operating staff and the officials in charge of them look on the care of fixed cables as the electrician's job and the care of cables which have to be moved each day as something they can do nothing about. A cable carrier, states the Inspector, should be used if the seam is high enough, but many of the power loaders in the division are less than 3 ft. 6 in. high. If a cable carrier cannot be

TABLE 2.—*Incidence of Accidents in the Two Districts Forming the Division.*

District.	Killed.		Seriously injured.		Total.	
	1960.	Average 1957-59.	1960.	Average 1957-59.	1960.	Average 1957-59.
Northumberland ..	16	13.0	100	93.0	116	106.0
Cumberland ..	5	4.3	10	11.6	15	15.9
Total	21	17.3	110	104.6	131	121.9

used and the loop end has to be dragged up and down the face it should not be left to take care of itself; someone should be clearly responsible for looking after it.

Some progress has been made in the maintenance of mechanical and electrical equipment, but a lot remains to be done before a manager's scheme of examination and test can be reckoned as working satisfactorily. It was emphasized last year that one of the main principles was that a manager should know exactly what was being done and must take the responsibility of seeing that essentials are covered and his staff are used to the best advantage. Check inspection shows that in some cases work is recorded as done, but has not, in fact, been done. This is because a mechanic or electrician has reported certain machinery as examined, whereas he has only carried out some of the work listed on his check-sheet. Records must be true if a scheme is to have any value and managers must make sure that the efficiency of their schemes is properly checked.

The number of horses employed at the coal mines in the division was 1,249, a reduction of 58 since the beginning of 1960. Mr. R. Garbutt, HM Inspector of Horses, carried out inspections in the Durham division, where he examined every horse employed underground at least once and many of them more frequently. The horses were found to be in good working condition and well cared for. All stables were found to be clean and properly constructed. New stables have been built at Lynemouth and Ellington collieries. During the colliery holidays 230 horses were brought to the surface and turned out to grass.

Roof Bolt Modifications

TWO types of modified roof bolt have been designed in the National Coal Board's East Midlands Division by Mr. M. H. B. Pickering, strata control engineer, and Mr. J. Winfield, deputy manager, Warsop Colliery. The modifications consist essentially of surrounding the bolt rod with a mild-steel tube of 1½ in. outside diameter. In one type the bolt rod remains unaltered, being surrounded by the tube which is free to move round the rod. In the other type the greater part of the bolt rod is dispensed with, the ends of the bolt being welded to a mild-steel tube.

The close contact between the outside of the steel tube, throughout its full length, to the sides of a standard 1⅛-in. drill hole, offers support to the roof along the full length of the bolt. In the event of the face breaking away from behind the bolt plate—which is normally tightened to the face—the steel tube will still offer support to the roof throughout the greater part of its length.

A further advantage of these modified roof bolts over the standard quick-setting stud type is their increased bending strength in the event of the roof becoming detached along the length of the bolt.

ACCORDING TO the annual report of the Brazilian Companhia Siderúrgica Nacional (CSN), production of ingot steel, which amounted to 1,000,000 tons in 1960, will be raised to 1,100,000 tons in 1961 and to 1,400,000 tons in 1963.

DEWATERING FROTH-FLOTATION TAILINGS

MR. A. E. WHITTLE, an Area coal preparation engineer in the National Coal Board's North-Eastern Division, has devised an apparatus, at much reduced cost, for separating water from froth-flotation tailings to the point where the solid residue can be handled for disposal as refuse. What has come to be recognized as the traditional method for treating froth-flotation tailings is the concentration of the tailings in a thickener, and further concentration of the sludge to a firm cake in filter presses, this firm cake being transportable by belt conveyor, dumper, or ropeway buckets along with the normal washery discards.

A range of new flocculating reagents has recently been made available. These reagents, some of which are being patented, give quite high settling rates, *i.e.*, in excess of 2 ft./min. (The older reagents usually worked at 3 in. to 5 in./min.) More important is that the settled sludge appears to be almost water repellent in that it will freely drain, and when subject to slight mechanical movement becomes almost solid. With settling alone it consolidates to a handleable mass. The residual water is clear.

Mr. Whittle's apparatus has been designed to take advantage of these properties. The apparatus essentially is a cone of greater depth than diameter. The process receives the tailings that would normally have gone to the thickener. The dilute reagents are fed into the tailings, which are then agitated and passed to the centre curtain of the cone.

Flocculation is instantaneous and gives a continuous clean water overflow from the rim of the cone. The sludge settles to the bottom of the cone and is released by a suitable discharge, which could be the subject of automatic control. This sludge is sufficiently rigid to travel to disposal by the normal mehods (rubber belt, scraper conveyor, dumper, or ropeway bucket) without any further treatment. Further dewatering of the material can be achieved by subjecting it to suitable mechanical movement within the cone or after discharge from the cone.

New Indian Coal Mines

TWO new coal mines in the Ramakrishnapur area of the Government-owned Singareni group of collieries in Hyderabad, have been opened. They were named after Rabindranath Ragore and Motilal Nehru to mark the birth centenary celebrations of the two illustrious sons of India.

The inauguration of the two mines—Rabindra Ghani and Motilal Ghani—was performed by Major N. K. Guriswamy, managing director of Singareni Collieries.

A SEAMLESS STEEL tube plant with an annual capacity of 80,000 tons is to be laid down at the Riesa works in East Germany.

New Literature

HOUSE magazines, catalogues, booklets, and other publications received are mentioned below. Readers wishing to obtain a copy of any of the items should write to the address given, at the same time mentioning this journal.

ENGLISH ELECTRIC COMPANY, LIMITED, Stafford—F. Killoran, of the company's mining division, contributes an article on "Computers as an Aid to Electric Mine Winder Design" to the June number of the English Electric Journal.

MORGANITE ELECTROHEAT, LIMITED, Point Pleasant, Wandsworth, London, S.W.18—The varied applications in which "Crusilite" heating is being employed to increase efficiency and productivity in many industries are described in a very attractive brochure (TD20/61).

ROLLS-ROYCE, LIMITED, Oil Engine Division, Derby The many forms and applications of Rolls-Royce diesels are described in a series of brochures. The leaflets have been bound and issued under the title "Data on Rolls-Royce Diesels." In this way they form a valuable reference guide.

S. A. COCKERILL-OUGRÉE, Service "Publicité," Seraing, Belgium—Recently issued is the second in the series of technical reviews published by this well-known Belgian undertaking. An article on the new sintering plant at the pig-iron division at Ougrée is among the interesting contributions.

SOLARTRON ELECTRONIC GROUP, LIMITED, Victoria Road, Farnborough (Hants)—The annual review of the company (a member of the Firth Cleveland group) gives an impressive account of its activities in the field of electronics. Those interested in the subject will find the report a useful document.

PARKINSON COWAN MEASUREMENT, P.O. Box No. 2, Dobcross, Oldham (Lancs)—A two-colour leaflet describing the recently introduced Type 33 full flow water meter is now available. In addition to a technical description the leaflet gives dimensions, performance data with a graph, and a sectionalized view of the new meter.

CRODA, LIMITED, Cowick Hall, Snaith, Goole (Yorks)—Latest in the technical data sheet series is concerned with black dewatering rust preventive G.P. 2587, a quick-drying dewatering rust preventive which leaves a smooth hard film on metal surfaces. It contains no abrasive substances and is, of course, entirely free from water and corrosive matter.

PARKINSON COWAN GAS METERS, Terminal House, 52, Grosvenor Gardens, London, S.W.1—"High-pressure Industrial Gas Meters by Parkinson Cowan" is the title of an illustrated four-page leaflet, which describes and illustrates the construction of the B 1200 and B 2000 high-pressure meters and also provides useful performance curves, dimension diagrams, and abridged specifications.

RICHARD THOMAS & BALDWINS, LIMITED, 82, Brook Street, London, W.1—A major industrial project such as the erection of the Spencer Works cannot be undertaken by one company in isolation. The co-operation of local authorities, contractors, and other organizations is of vital importance. A feature in the June edition of Ingot News outlines the work undertaken by British Railways at Newport.

ATLAS COPCO (GREAT BRITAIN), LIMITED, Maylands Avenue, Hemel Hempstead (Herts)—Now nearing completion is a new drainage tunnel system totalling more than a mile length beneath the city of Rochester, N.Y. Average speed of advance since the spring of 1959 has been 35 ft. a day during single daylight shifts. The story is told and illustrated in the latest issue (Vol. 4, No. 2) of Compressed Air Comments.

MANDOVAL, LIMITED, Barrington House, 59, Gresham Street, London, E.C.2—"The Vermiculite Handbook," just published by the company, is said to be the first comprehensive handbook on vermiculite and its uses. The 40-page book is copiously illustrated and printed in two colours throughout. After describing the material and its properties the book goes on to outline in considerable detail the widespread uses of vermiculite.

BRITISH OXYGEN COMPANY, LIMITED, Spencer House, St. James's Place, London, S.W.1—Articles on oxy-acetylene welding in the construction and maintenance of British Railways permanent way, a survey of the properties of nitrogen and its industrial uses, thermic boring—a vibrationless method of drilling through rock or concrete—and other subjects are included in the spring number of Torch, the journal of the company's light industrial department.

NATIONAL AND MIDLAND IRONFOUNDERS' ASSOCIATION, 69, Harborne Road, Edgbaston, Birmingham 15—"Iron Castings for Industry" is the title of a booklet issued to draw attention to the properties and varied applications of grey iron castings. It is hoped that it will assist buyers, designers, draughtsmen, and others concerned in the specification of materials, to assess more accurately the merits of iron castings. The booklet is very well produced and compiled.

INTERNATIONAL NICKEL COMPANY (MOND), LIMITED, Thames House, Millbank, London, S.W.1—Nickel, *per se* or as a constituent of alloys and steels, plays a vital role in virtually every branch of industry. The abstracts contained in the April issue of the Nickel Bulletin provide an apt illustration of the diversity of the research and development work in progress on nickel-containing materials. The issue contains the usual quarterly review of recent patent literature.

CLARKE, CHAPMAN & COMPANY, LIMITED, Victoria Works, Gateshead 8 (Co. Durham)—A 20-page brochure (publication 26B) has been produced to outline the range of the company's manufactures. The full list is impressive in length and scope and the brochure illustrates many of the products. Three leaflets have also been issued. Publication No. 94 is concerned with "Hydropower" hydraulic machinery, No. 213 with a.c. cargo winch with three-speed squirrel cage motor, and No. 216 with electrically driven automatic constant tensioning mooring winch.

FEDERATION OF BRITISH INDUSTRIES, 21, Tothill Street, London, S.W.1—What are the advantages of a system of decimal coinage? What is industry's view? How would the changeover work? These questions are discussed by C. A. J. Martin, an expert on the subject, in the first of two articles on decimalization in the June number of the FBI Review (2s. 6d.). In the same issue Michael Shanks, industrial editor of the Financial Times, writes on "The Mid-year Outlook" ("long-term problems in the UK economy remain, but immediate prospects are encouraging," he says), S. Hardie Stewart writes about South Africa's economic outlook following her decision to leave the Commonwealth, and there are also many other articles on a variety of topics to interest those concerned with trade and industry generally.

PLOUGH FOR ARMOURED FLEXIBLE CONVEYOR

A DEVICE for ploughing coal off an armoured conveyor (Fig. 1), developed at the National Coal Board's Central Engineering Establishment, has been manufactured and successfully used at Swadlincote Colliery, in the East Midlands Division. It comprises a conveyor pan with a shaped hole in its deck plate (which permits the small fractions of coal to fall through onto a receiving conveyor) and a curved steel sheet obliquely mounted across the pan so that large

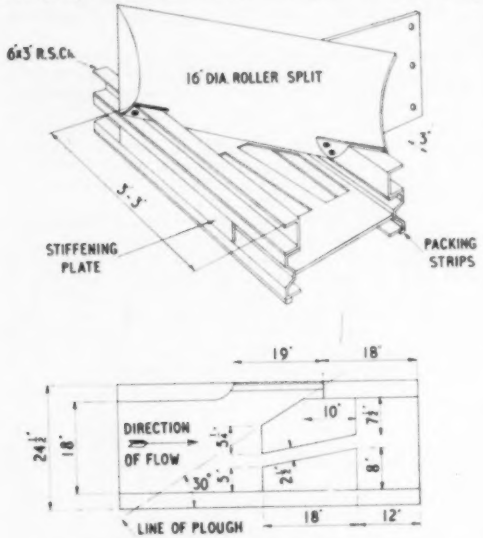


FIG. 1.—DEVICE FOR PLOUGHING COAL OFF AN ARMOURED CONVEYOR.

coal is ploughed off. Part of the top chain race of the pan is cut away at each side forming slots to accommodate the plough.

To the underside of the bottom chain race square bars are welded, one on each race, along the length of the pan to ensure that the bottom chain of the conveyor is raised clear of a stage loader across which it is laid, and to provide clearance for bent flights. The pan is stiffened by plates welded along its sides.

By using the device, an armoured flexible conveyor can be laid across a stage loader and the travel of the cutter loader is not then restricted by the armoured face conveyor head and ramp pan. In addition, the stable for the cutter loader can be shorter. Supporting the roadhead is thus made easier, as only the normal conveyor width has to be accommodated. The danger of large lumps of coal fouling the roadhead roof bars is greatly reduced, and the problem of small coal being taken back by the bottom chain of the face conveyor is eliminated.

The suggestion for the device was made by Mr. W. E. Jones, undermanager at Swadlincote Colliery.

AUTOMATIC SURFACE HANDLING OF COAL

MODEL of a new automatic system designed and built by English Electric apprentices was demonstrated at the company's Thornbury, Bradford, works to 60 members of the Association of Mining Electrical and Mechanical Engineers during their recent annual convention at Harrogate. The working model is of a fully automatic system for the surface handling of coal. The mobile display is in a special demonstration van, fitted out by the company's mining division. The van is making a six months' tour of the mining areas. At each centre experts in the application of electronic equipment to mining problems are demonstrating how mine cars can be removed from a cage, emptied, and returned completely automatically.

The new system will not displace men. The electronic equipment is more reliable than conventional electro-mechanical gear and needs less maintenance. The operator can also take manual control to interrupt the sequence of operations, *e.g.*, to send mine cars down containing materials. The model, which includes the winding gear, tubs, tipplers, and rams, was designed and constructed by a team of technician and craft apprentices at Stafford under the guidance of mining experts.

Also on show was a 13-ton flame proof battery-operated mining locomotive for use underground. Designed at Bradford and made at Darlington, the locomotive can haul a train of seven 17-cwt. cars which can hold a total of 168 men. Visitors also saw during their tour films of the company's mining activities and electric motors being manufactured for two new coal-preparation plants in Yorkshire.

FORTHCOMING EVENTS

JUNE 27

Combustion Engineering Association (North Western Region):—Meeting at the Engineers' Club, Albert Square, Manchester, at 2.30 p.m. "Shortcomings in Present-day Equipment," by Prof. M. W. Thring.

JULY 3

Southern Counties Institute of Mining Engineers:—Visit to the Ford Motor Company, Limited, Dagenham (Essex).

JULY 17 and 18

Institution of Mining Engineers:—Junior section meeting in Nottingham.

JULY 19-21

Institution of Mining Engineers:—Summer meeting in Nottingham.

National Association of Colliery Managers

JULY 5

North of England Branch:—Meeting at the Mining Institute, Neville Hall, Newcastle-upon-Tyne, at 6.45 p.m. Presidential address on "Safety in Mines," by J. T. Robson.

In this paper, which was presented to the Newport and District Metallurgical Society on January 18, 1961, the author describes the modern open-hearth furnace and indicates the changes in its design and operation which, in recent years, has greatly increased its productivity. After describing the essential features of steelmaking by the electric arc furnace, LD, Kaldo, Rotor, and the "oxygen mixture" bottom-blown converter processes, the author gives a comparison of the capital and operating costs for open-hearth, electric furnace, and LD plants, and a combination of LD and electric furnace plants. A summary of the discussion on the paper is also given.

Alternatives to the

Open-Hearth Process

by Dr. A. J. KESTERTON, F.I.M.

(Steel Company of Wales, Limited, Port Talbot)

BEFORE considering the available alternatives to the open-hearth furnace, it is necessary to describe the characteristics of modern open-hearth furnace practice. It may then become clear which other processes, either singly or in combination, are economic alternatives to the open-hearth furnace.

Modern Open-hearth Operation

Since the war there has been a great deal of development in open-hearth design and operation. Some of this development is being very actively carried out at the present time, and neither the results nor the consequences of this can yet be finally assessed.

Furnace Size

In the first place, the size of open-hearth furnaces has been greatly increased. Whereas pre-war fixed furnace installations were usually of a maximum capacity of about 100-120 tons, post-war furnaces have generally been in the range 200-300 tons. Most furnaces currently being installed are in the range 350-500 tons capacity. Additionally, once installed the charged weights of the furnaces have been consistently increased in most plants by up to 25 to 35 per cent., this being achieved generally by lengthening the hearth. This increase in charged capacities is based on the general experience that the tap-to-tap time does not increase proportionately with the increased charged weight, and hence greater productivity is achieved.

Fuel

Especially in this country, open-hearth fuels have changed. Lean fuels such as producer gas have been largely replaced by oil, tar, pitch creosote, or coke-oven gas. With these concentrated fuels greater thermal inputs and higher flame temperatures are achievable, with faster melting rates. For furnaces of 200 to 300 ton capacity, thermal inputs in the range 125,000,000 to 150,000,000 B.t.u./hr. are common during scrap charging. This corresponds to 700 to 850 gal. oil/hr. At the Steel Company of Canada in 300-ton furnaces, maximum fuel inputs of 180,000,000 to 210,000,000 B.t.u./hr. are used, corresponding to 1,000 to 1,200 gal./hr.

Bottom Maintenance

Fettling time in many plants, particularly those making low-carbon steel, has been greatly curtailed by the use of magnesite both for installing the hearth monolith originally and for fettling after each tap. Fettling time in such cases has been consistently reduced to a range of 30 to 40 min., and the material consumed reduced from 100 lb./ton dolomite to 20 to 25 lb./ton magnesite. An advantage of the open-hearth furnace compared with converter processes, is that the working hearth is continually renewed and may be operated for years.

Converter linings require renewal every 150 to 300 heats.

Hot Metal Quality

The quality of hot metal for open-hearth furnaces has continued to improve as blast-furnace practice has also developed. In this country the Si and S contents of the hot metal are lower and of greater uniformity, and the P has also tended to fall as ores from other parts of the world, mostly low in P compared with home ores, have become available. The metallurgical load of the open-hearth charge has therefore fallen, resulting in thinner slag layers and hence quicker melting by more rapid heat transfer to the bath and shorter refining times. At the same time, it has been possible to produce steels with more stringent specifications for S, P, and C.

Scrap Preparation and Charging

Charging box size, scrap preparation, and scrap handling layouts have received intensive development to match the faster charging rates demanded by the increased furnace capacity and fuel inputs.

Instrumentation

Instrumentation and automatic control of open-hearth operation has also been developed to maintain continuously optimum conditions throughout the furnace system, *e.g.*, maximum fuel input in relation to maximum permissible roof temperature, maximum furnace pressure to prevent air filtration, linkage of waste-gas oxygen analysis to air/fuel ratio to ensure burning all CO reaction gas, and continuously to provide in the furnace atmosphere the oxygen required by the oxidizing reactions proceeding in the bath.

Refractories

The quality of all refractories used in the open-hearth furnace, particularly silica and chrome-magnesite, have continuously improved. This has enabled a reasonable furnace life to be obtained in spite of the much more arduous operating conditions, such as greater fuel inputs, higher temperatures, wider span roofs, and use of oxygen for combustion and refining.

In particular, and only very recently, there has been a great outburst of activity directed at developing the all-basic roof. Many methods of roof construction are being tried, as well as various types and compositions of brick. A great deal of progress has already been made, and in a relatively short time there is no doubt that the optimum method of of construction and brick quality will have been developed. The advantages to open-hearth operation of a successful design of all-basic roof are considerable and, in conjunction with the use of oxygen, will decisively affect the operating economics of existing furnaces.

Succinctly, the all-basic roof permits the furnace to be operated at much higher roof temperatures for longer periods, that is, with greater fuel inputs, and oxygen accelerated combustion. It also allows oxygen to be used continuously via roof jets for refining from hot-metal addition onwards. This practice has a dramatic effect in reducing tap-to-tap time. It is hardly practicable under silica roofs, since the temperatures achieved and the splashing of the basic slag destroy the silica bricks in a very short time.

Segmental Construction

Within the last two years, a significant development which will speed up the repair time and increase availability has taken place with respect to the construction of the open-hearth furnace itself. This development is an engineering modification of the Maerz-Boelens design of furnace, in which the front wall, back wall, and roof are built in replaceable sections. These sections may be quickly removed when worn out and very rapidly replaced by prefabricated units.

The installation of uptakes, fantail, and chill arches and regenerator roofs in suspended tiles has been gathering momentum during the past 10 years. This type of construction substantially reduces repair time because it contains much less brickwork and has greater stability. Also basic bricks can be used, these giving a longer life than silica, which is the only possibility in the slag pocket and fantail arches of the conventional construction.

Use of Oxygen

General.—In recent years, however, by far the most important development in open-hearth practice has been in the use of oxygen. Open-hearth steelmaking is principally a combination of scrap melting, and refining by oxidation of the metalloids in the hot metal, carbon, silicon, and phosphorus.

Oxygen used for flame enrichment accelerates combustion, raises flame temperature, and permits a greater heat input because a larger quantity of fuel can be burnt for a given waste-gas volume. Heat transfer to the charge can be greatly increased, resulting in more rapid melting.

Oxygen has an even more dramatic effect on the oxidizing reactions. It is normally applied to the surface of the bath through water-cooled jets, entering via the roof of the furnace. Not only is pure oxygen provided directly for oxidizing the metalloids, but gas nuclei are made available in large quantity to sustain oxidation of carbon to carbon monoxide. Further, the vigorous boil created greatly increases mixing at the slag-metal interface, and hence facilitates the transfer of heat and oxygen from the furnace atmosphere downwards into the steel, and the transfer of sulphur and P_2O_5 in the reverse direction from the steel into the slag.

Both the above methods of using oxygen in open-hearth furnaces demand much oxygen, and if applied therefore to several furnaces, tonnage-oxygen plants are necessary. Only during the past four years in this country has a start been made in the installation of such plants.

Substantially, this is the position in most other countries, including the USA. The drive to put in tonnage oxygen plants is, however, rapidly gathering momentum, and the massive use of oxygen in open-hearth operation will very quickly bceome general practice. Plants not adopting the use of oxygen will not remain economic and competitive.

Generally so far, there has not been sufficient oxygen available for using both for flame enrichment and for oxidation of the metalloids via roof jets. Also, extensive use of the latter practice, due to the large volume of brown fume produced, can only be carried out on furnaces equipped with waste-gas dust-cleaning equipment.

For Flame Enrichment.—Oxygen for flame enrichment is used in the range 300 to 900 cu. ft./ton of steel. This gives an increase in productivity of from 10 to about 25 per cent. in a single furnace, depending upon whether additional fuel is also used. At Consett, for example, the use of 800 cu. ft. oxygen per ton increased ingot output by 13 to 15 per cent. in furnaces of 150-ton capacity charging about 65-70 per cent. scrap.

For Refining.—The use of oxygen for refining via roof jets is very efficient, mainly because oxygen and heat are delivered direct to the metal bath, by-passing the slag barrier.

Oxygen used in this way is normally about 500 to 600 cu. ft./ton. In a 200 to 300-ton furnace the lances will be lowered immediately after the addition of hot metal, and the initial flow will vary between 20,000 and 30,000 cu. ft./hr., depending on the vigour of the reaction. As the reaction subsides the oxygen flow is steadily increased, until in the final stages, when the carbon is very low, below about 0.20 per cent., the rate may be 60,000 to 70,000 cu. ft./hr.

In the future, however, these blowing rates will certainly increase. During the oxygen blowing, particularly in the early stages, the fuel input is severely restricted, often completely turned off, but enough combustion air is supplied to burn the CO arising at the reaction zones. The fuel consumption/ingot ton is therefore greatly reduced as compared with normal practice.

The time from hot metal addition is reduced to between 2½ and 3 hr., and the tap-to-tap time to between 6 and 7 hr. on the average, though many charges operated with oxygen in this way have been tapped in 5 to 6 hr., and even between 4½ and 5 hr. Provided that charging and casting bay facilities are adequate, 250 to 300-ton furnaces will operate at rates of 40 to 60 ton/hr.

It is interesting to compare these productivity rates with those for a typical furnace operating pre-war. A 100-ton pre-war open-hearth furnace on, say, 50 per cent. hot metal, would operate at about 8 ton/hr. in this country.

Trials by Ford Motor Company, Detroit.—Few furnaces have so far been operated using oxygen both for flame enrichment during cold charging, followed by oxygen via the roof jets for oxidation of metalloids. This is a development, the results of which will be awaited with considerable interest by open-hearth operators.

In this connection, some work which illustrates the potential, has very recently been carried out by the Ford Motor Company in its steel plant at Detroit. One particular heat has been described, in a furnace of 200-net ton capacity operating with 50 per cent. hot metal, in which during cold charging the furnace was fired through the normal end burners with fuel oil at the rate of 126,000,000 Btu/hr., plus 30,000 cu. ft. oxygen/hr., and also with 30,000 cu. ft./hr. of natural gas mixed with 48,000 cu. ft./hr. of oxygen, introduced through each of the two roof lances.

The cold charging time for 100 tons of scrap was only 23 min., followed by door banking and hot-metal addition in a further 20 min. At this stage the natural gas was turned off, refining proceeding with oxygen only through the roof lances at 48,000 cu. ft./hr. The time from start charge to tap was 2 hr. 50 min., the output rate being 70.2 net ton/hr., the oxygen consumption 1,575 cu. ft./net ton, and the fuel consumption 1,368,000 Btu/net ton. Over the total fuel input of oil plus methane, the oxygen supplied is sufficient for about 33 per cent. of the combustion requirements.

Comparison with 100 per Cent. Oxygen

The consequences to steelmaking practice, in general, and in particular to open-hearth operation, of burning the fuel totally with oxygen, that is, no air, should, in the opinion of the author, be reviewed. One important result of burning fuel 100 per cent. with oxygen is that the products of combustion are heavily dissociated, H_2O into hydrogen and oxygen and even monatomic hydrogen and oxygen, and CO_2 similarly. For example, fuel oil and oxygen give a maximum flame temperature of only 2,800 deg. C. Of the total heat content of the flame, 56 per cent. is latent heat of dissociation, and of the total heat available above 1,500 deg. C., 70 per cent. is latent heat. This latent heat of dissociation will be released when the flame is cooled, for example, when it strikes the cold surface of charged scrap. Transfer of heat in this way from flame to scrap should be extremely efficient, being, in fact, by a type of surface combustion.

A second effect is that the quantity of useful heat released above say 1,500 deg. C., that is, the useful heat in an open-hearth furnace, is much greater than for combustion with air or partly enriched air. This should result in a greatly improved thermal efficiency, and the ability to consume higher percentages of coolant such as scrap or ore.

Another important effect is that the volume of waste gases is considerably reduced, which should permit reductions in the size of regenerators, boilers, and fume-cleaning equipment required for a furnace of given capacity.

The total combustion of the fuel with oxygen at least during scrap charging, *via* roof lances is a development which will probably take place in open-hearth steelmaking. When coupled with the use of oxygen for refining from the hot-metal addition onwards, it is likely to affect the design, operating efficiency, and productivity of open-hearth furnaces profoundly. The open-hearth furnace may then remain competitive with large LD converters.

The Ajax Process—An extreme example of the use of oxygen in the open-hearth furnace by means of roof jets for refining is provided by the Ajax process. A 300-ton tilting furnace has been extensively modified. The conventional twin uptake port ends are replaced by refractory lined cylindrical tubes through which, at each end of the furnace, a retractable water-cooled oxygen lance slopes down towards the bath. The oxygen is supplied alternately from each end, as the furnace is reversed.

An unusual feature of this design of furnace is that the downtake at each end leads to a twin set of slag pockets and regenerators. This enables the furnace to operate through one set, while the other is under repair. The change over from one to the other takes only a few hours, so that furnace repair time is reduced and a high availability maintained.

The regenerator capacity, however, is of necessity rather small in consequence and the furnace is therefore not designed to burn very much fuel, though enough hot air is provided to burn the CO arising at the reaction zone. In fact, the furnace melts little or no scrap, and the fuel is used generally only during slagging off, and at the end of the heat for maintaining tapping temperature, if the oxygen lancing is reduced to catch the carbon.

With this design, the downtakes, slag pockets, and regenerators are completely steel encased, preventing air infiltration, and thereby reducing the load on the gas-cleaning plant.

The furnace produces about 200 tons of steel per heat consuming from nil to 10 per cent. scrap, the hot metal analysing about 1 per cent. P, Si 0.2 per cent.

The tap-to-tap time averages about 7 hr., *i.e.*, equal to about 30 ton/hr. The average oxygen rate is 40,000 to 60,000 cu. ft./hr., and the consumption *via* the lances for bath oxidation about 1,000 cu. ft./ton. In addition, 500-600 cu. ft./ton are used to accelerate combustion of the fuel. Fuel consumption is only about 1,200,000 B.t.u./ton.

Versatility of the Open-hearth—The open-hearth furnace is an extremely versatile steelmaking unit, more so than many alternative types of furnace. It will deal with a great range of scrap to hot-metal ratios, from 100 per cent. scrap to about 80 per cent. hot metal. Electric furnaces by comparison melt mainly all-scrap charges or up to about 25 per cent. hot metal.

The oxygen converters of the LD type will melt up to about 25 to 30 per cent. scrap, conventional Bessemer with oxygen enriched blast up to about 10 to 15 per cent. scrap, and steam/oxygen blown Bessemer 5 to 7 per cent. scrap. The Kaldo rotary converter, because oxygen is supplied to burn the CO, could melt up to 40 per cent. scrap, but this type of converter is not designed for heavy scrap charges, and it is more general to use large quantities of ore as coolant.

The open-hearth furnace therefore will, on its own, cope with the varying scrap to hot-metal ratios which arise in normal practice, such as those caused by a blast furnace under repair, changes in the relative prices of scrap, or hot metal.

For this reason, and having regard to the fact that the overall steelmaking burden must consist of nearly 50 per cent. scrap, plants operating with alternative types of furnace must work in conjunction with other units consuming the balance of the material which they are unable to handle. For example, electric furnaces, which do not consume much hot metal, must be balanced by hot-metal furnaces in some other plant.

Similarly, high percentage hot-metal converters must be associated somewhere with mainly scrap melting units such as electric or open-hearth furnaces. The alternatives to the open-hearth have therefore largely been installed by companies already operating other steelmaking processes.

The steel qualities which can be produced in the open-hearth cover virtually all types of steel required for any industrial application. Only a few very high-alloy steels, such as stainless, are preferably made in electric furnaces.

Electric Arc Furnaces

The electric furnace is an alternative to the open-hearth principally in respect of the scrap melting function. In this regard the modern electric furnace has several advantages.

Charging is very rapid, since it is effected by swinging the roof and electrodes to one side and discharging into the vessel the contents of a large scrap container *via* a segmental bottom. In this way as much as 60 tons of scrap may be charged in 6 min. This charging practice also reduces the amount of scrap preparation necessary as compared with that required for charging open-hearth furnaces by means of relatively small boxes.

Scrap preparation is therefore less expensive and cheaper types of scrap can be utilized. Compared with the open-hearth, a higher ratio of scrap to pig-iron can be used to give the necessary melt carbon, because of the non-oxidizing nature of the electric furnace atmosphere; this is advantageous if scrap is lower in price than pig-iron.

The temperature generated at the arcs is very high and is developed in the middle of the scrap, so that heat transfer is very efficient.

For scrap melting, therefore, the arc furnace is technically excellent.

Modern developments in furnace design and equipment have been in the direction of larger furnaces, bigger power inputs from transformers of greater capacity, and improved regulator control of the arcs, resulting in lower current and electrode consumption, reduced heat times, and the use of higher power factors.

As a result electric furnaces up to 150 to 180-ton capacity have been constructed, with 30,000/35,000 kVA transformers, capable of tapping in 5 to 6 hr., *i.e.*, at 25 to 30 ton/hr.

Refractories are the factor limiting transformer capacities, since greater power inputs to three-electrode furnaces result in long high-voltage arcs, which are very damaging to the refractories. The

efficiency of heat transfer to the scrap is also reduced by having only one centralized heat source in a furnace of large diameter, the scrap at the periphery being shielded from the arcs. It will be necessary to design a six-electrode furnace, if furnaces of greater capacities are required.

Again, a three-electrode furnace of large capacity tends to require a deep bath to accommodate the charge. This is a disadvantage if it is desired to incorporate hot metal in the charge, and this is especially the case if the hot metal is of high metallurgical load, that is, high in silicon and phosphorus.

The modern large electric furnace, therefore, being substantially a cold scrap and pig melter, is limited with the three-electrode design to a maximum shell diameter of about 24 ft., a capacity of 150 to 180 tons, and a 30,000 to 35,000 kVA transformer, giving a maximum production rate of about 25 to 30 ton/hr.

If making plain carbon steels, in competition with open-hearth furnaces, the electric furnace will generally be operated with a single oxidizing slag, though two oxidizing slags may be necessary if the sulphur is high. Oxygen is applied by means of bare lances through the doors for oxidation of carbon after the melt if low-carbon steel is required. There is no pick-up of sulphur from the fuel. Steel comparable with open-hearth can therefore be produced, except for the rather higher nitrogen of 0.006 per cent. This is a disadvantage, for example, in the manufacture of deep-drawing sheet steels.

The metallic yield is high at about 90 to 91 per cent., due to the low slag bulk and non-oxidizing conditions in the furnace.

The furnace availability is generally higher at about 90 to 92 per cent., than conventional open-hearth furnaces, largely due to the smaller total brickwork included in the furnace, and to the fact that the roof, which is the area of greatest wear and which may only have a life of 25 to 50 heats, is with the swing roof construction, very quickly replaceable. Refractory consumption per ton of steel averages about 15 lb. silica brick, 12 lb. basic brick, and 25 lb. dolomite for fettling.

The greatest item of operating cost is that for electrical energy. About 550 kWh are consumed per ingot ton, so that fuel alone costs about £3 per ton. In addition, there is a consumption of about 12 lb. per ton of electrode graphite, costing £1 per ton.

There is little doubt that the large, top charged electric arc furnace equipped with very powerful transformers of the order 30,000 to 35,000 kVA, and operating at 25 to 30 ton/hr. on all-cold charges, mainly scrap, is an excellent alternative to the cold charged open-hearth furnace, and it may be confidently estimated that no further open-hearth furnaces will be built in non-integrated steelplants to handle cold scrap and pig charges.

In confirmation of this, it has been announced recently that the United Steel Companies, Limited, intends to replace the 14 100-ton open-hearth furnaces in its Templeborough cold-metal melting shop by six 100 to 110-ton capacity electric arc furnaces, which it is estimated will produce 1,350,000 tons per year.

The LD Process

As is now well known, the LD process is carried out in a vessel of similar shape to that of the traditional Bessemer converter. The charge of hot metal and scrap is converted to steel by means of a high-speed jet of oxygen projected onto the surface of the bath, *via* a water-cooled probe, lowered through the mouth of the converter.

A main feature of difference is that bottom-blowing is not involved. This is of importance in that the bottom of the LD converter lasts the life of the lining, which may vary from 150 to 300 heats. An air or oxygen/air blown converter bottom may have a life of 60 to 80 heats, and a steam/oxygen blown bottom 40 to 50 heats. Since bottom changing will take 15 to 20 hr. in large converters, the LD converter has an advantage in higher availability.

The LD process was originally developed in Austria to refine low-phoshorus hot metal in the range 0.10 to 0.20 per cent. The silicon can vary over a wide range from 0.25 to 1.25 per cent., the amount of coolant charged, either scrap or ore, being adjusted to suit the percentage of silicon. About 25 per cent. scrap would be used with hot metal of percentage analysis C 4.0, Si 1.2, P 0.2.

The scrap is charged first, followed by the hot metal and the necessary lime only after the lance has been lowered and a "light" obtained. A particular feature of the top blown oxygen process is that the FeO formed from the oxidation of iron not only reacts with the metalloids, such as silicon, carbon, of the hot metal, but is in immediate contact with the lime.

In the reaction zone, therefore, a very high temperature is developed, which rapidly produces a hot fluid oxidizing basic slag from the lime, silica, and iron oxide. In these circumstances phosphorus is oxidized at the same time as the carbon, and as a result phosphorus can be substantially eliminated by the time the carbon drops to 1.5 per cent.

Additionally, the early slag formation, coupled with the absence of any sulphur bearing fuel, facilitates the elimination of sulphur. Also, since air is not used for oxidation as in the conventional bottom-blown basic-Bessemer process, or for combustion of fuel as in the open-hearth, the pick-up of nitrogen is low.

From hot metal percentage analysis C 4.0, Mn 0.80, Si 1.2, P 0.20, S 0.5, consuming about 25 per cent. scrap, and operating a single slag practice, the typical percentage analysis of the resulting steel would be C 0.06, Mn 0.35, P 0.015, S 0.015 to 0.02, N_2 0.0025 to 0.003.

Such steel has been used with every satisfaction for many important applications, including deep-drawing sheets, tinplate, structurals, pipes, and by catching the carbon, for higher carbon steels, *e.g.*, rails. Compared with a blowing time of 10 min. for the bottom-blown converter process, the LD

has a longer blowing time of 20 to 25 min., so that the average cycle time is correspondingly increased to about 45 to 55 min. The output rate is reduced in consequence, but this is offset by the greater availability resulting from the elimination of the bottom change, and a converter of equivalent size will operate with a bigger charge weight.

The classical single-slag LD process works satisfactorily on low-phosphorus hot metal, say, up to 0.3 per cent. Beyond this, final phosphorus elimination to low levels becomes difficult, and attempts have been made to modify the operation to cope with higher phosphorus hot metal, for example, by adding fluorspar to facilitate early slag formation, and by operating with double slag practice. Irons containing up to 1.3 per cent. phosphorus have been fairly successfully operated in this way, though there are considerable disadvantages; for example, the greater slag bulk involves bigger iron losses and the cycle time is prolonged by up to 40 per cent.

Probably a more satisfactory approach to the problem of refining higher phosphorus irons is the recently developed LDAC modification. In this, the top-blown oxygen jet carries entrained lime powder (size <3 mm.) Thereby lime, having a very large surface area, is introduced into the zone of highest temperature, where iron oxide in greater quantity is being produced. Very early slag formation is facilitated, leading to rapid elimination of phosphorus.

This process has been successfully operated on irons containing up to 1.8 to 2.0 per cent. P, with silicon usually in the range 0.3 to 0.5 per cent., and S 0.04 to 0.06 per cent. About 25 per cent. scrap is required as coolant. The first slag is decanted when the carbon has fallen to about 0.7 per cent. At this stage the phosphorus is between 0.2 and 0.4 per cent., the percentage slag analysis is CaO, 55; P_2O_5, 20 to 25; SiO_2, 8 to 9; MnO, 4; MgO, 1; Fe, 4 to 7, and is therefore valuable as a fertilizer, which provides a considerable financial credit. The final blow continues with oxygen and powdered lime, the steel produced having a percentage analysis, C, 0.06; Mn, 0.35; P, 0.015 to 0.025; S, 0.015 to 0.02; N_2, 0.0015 to 0.0025. Little is known as yet about the performance of this steel in product application.

The cycle time, however, is lengthened somewhat by the slagging off and by the practice at this stage of adding part of the coolant. Further, it will not accept oxygen at the same rate as the LD, due to the fact that the flow rate and the lime loading must be continuously adjusted to prevent excessive foaming of the slag with heavy ejections.

Again the greater slag bulks and longer blowing times adversely affect lining life, which is shorter than for LD operation.

The Kaldo Process

The 30-ton Kaldo converter as installed at Domnarvet, Sweden, where this process was developed by Dr. Bo Kalling, consists of a basic refractory lined cylindrical vessel, closed at one end, and with a central opening in the other end. It is capable of being rotated at speeds from 0 to 30 r.p.m. within two running rings, the latter being mounted in trunnions which enable the vessel to be tilted through the various angles necessary to permit charging, blowing, slagging off, and tapping.

The process was developed to refine high-phosphorus hot metal 1.8 per cent., but is easily adaptable to deal with low- or medium-phosphorus irons.

The oxygen lance penetrates the converter mouth about 3 ft. and plays a low pressure jet of oxygen (45 lb./sq. in.) on to the surface of the slag at a low angle of incidence, preventing appreciable impingement of oxygen on the molten metal. Oxidation, therefore, is substantially through the slag, which ensures early slag formation and phosphorus removal, and in addition sufficient excess oxygen can be added to the atmosphere in the converter to burn the CO to CO_2 as desired, thus producing a considerable quantity of heat. This heat which is absorbed in the first instance by the refractory lining above the bath, is transferred to the molten metal by virtue of the rotation. In this way the Kaldo process will consume larger percentages of scrap or ore as coolant than other oxygen steelmaking processes.

The 30-ton converter will consume up to 35 per cent. scrap, and it is believed that bigger converters may melt up to 40 per cent. In this respect the Kaldo converter approaches more closely to the open-hearth furnace, though the latter can easily cope with much greater percentages than this if desired.

It is claimed that the charging of scrap into a rotating converter does not seriously damage the refractory lining. However, it will probably increase the rate of wear, even if it does not do so catastrophically—there will certainly be an abrasive effect which would be absent if scrap were not charged. Again, compared with the open-hearth furnace, only the best, that is, the most dense, types of scrap are likely to be chargeable. For example, girders or rails 4 to 5 ft. long, will damage the lining.

The Kaldo lends itself to more precise control than other top-blown oxygen processes. This arises from the fact that oxidation proceeds mainly *via* slag-metal reactions, and the rate of these reactions may be controlled, and even selective metalloid oxidation obtained by varying the speed of rotation, and the flow of oxygen.

For example, in the early stages the formation of a liquid slag may be delayed, and hence the commencement of dephosphorization, by rapid rotation, the carbon being oxidized preferentially. Later, if the speed of rotation is reduced, a reactive oxidizing liquid slag may be produced, which will oxidize the phosphorus preferentially, the carbon falling only slowly. Near the end of a blow, a low iron oxide slag may be achieved by increasing the speed.

The temperature of the waste gases in the stack gives a very good indication of whether the carbon or the other metalloids are being oxidized. Preferential oxidation of carbon will give rise to CO

which burns to CO_2, raising the temperature in the stack. It may rise excessively if the carbon oxidation is proceeding too rapidly, resulting in volumes of CO, which burn in the stack itself. If, however, phosphorus is being preferentially oxidized, the temperature will fall. These variations in waste gas temperature may be used to determine the speed of rotation and rate of oxygen injection in order to control the course of the refining procedure as desired.

Combining the above methods of control with rapid bath sampling, the Kaldo process is very versatile in respect of the types of steel it will produce. From hot metal of percentage analysis C, 3.5; Si, 0.1; Mn, 0.8; P, 1.7; S, 0.055; steel analysing C, 0.06; P, 0.025; Mn, 0.35; S, 0.015; N_2, 0.002 may be produced. This type of steel has been found eminently suitable for deep-drawing sheet steel quality. The ingot yield is about 89 per cent.

It will be noted that the hot-metal silicon is only 0.10 per cent. At Domnarvet the hot metal is desiliconized ahead of the Kaldo process. This is mainly to prevent excessive slag foaming and to reduce the slag bulk. If desiliconization of the hot metal is not carried out, it would probably be necessary to remove an early slag containing most of the silicon soon after the start of the blow, which would prolong the cycle time.

The carbon can be caught at any level and, by selective control of metalloid oxidation, low-phosphorus analyses can be achieved at high-carbon levels, so that the Kaldo process may be satisfactorily used, for example, to produce semi-killed steels for ship plate.

The cycle time in the Kaldo process is relatively long. Refining high-phosphorus hot metal, two slag-offs will be necessary, the first at about 1.5 per cent. C, 0.4 per cent. P, and the second at 1.0 per cent. C, 0.10 per cent. P. The blowing time is long also. It is estimated therefore that a 30-ton converter will have an overall cycle time of about 80 min. consisting of 10 min. for charging hot metal and additions, 40 min. blowing, and 30 min. slagging off, sampling, and tapping.

A 100-ton unit will have a cycle time of about 120 min., consisting of 15 min. charging (this assumes ore and not scrap as coolant, and will therefore be longer for, say, 35 tons scrap charged), 60 min. blowing, and 45 min. slag off, sampling, and tapping. The 30-ton converter would produce a maximum of about 20 ton/hr., and the 100-ton converter a maximum of 50 ton/hr.

The Achilles heel of the Kaldo process is the life of the refractory lining. The high temperatures existing in the vessel, coupled with the driving of the slag against the lining by rotation, results in comparatively rapid wear and a life of only 50 to 60 heats. The consumption of dolomite is about 65 lb./ton. If dolomite blocks are replaced by magnesite, the life is improved to about 80 to 85 heats, but this increase is insufficient to cover the extra cost of the magnesite.

These figures compare with lining lives in the LD process of 150 to 300 heats, and similar figures in the basic-Bessemer process.

With a cycle time of from 1½ to 2 hr., a Kaldo vessel will require relining every three and a half to four and a half days in a two-vessel shop. This is a very tight schedule, allowing for cooling, demolition, relining, and reheating, and it is probable that more vessels will require to be installed to maintain the same availability by comparison with the LD process or open-hearth furnaces, and thus augment the capital cost of a Kaldo plant.

The Kaldo process is a direct alternative to the basic-Bessemer process and its variations using high-phosphorus hot metal, and also to the specialized high hot metal, high-phosphorus tilting open-hearth practice of the Lincolnshire and north-east coast districts of this country. It is not likely to be competitive with the LD process on low-phosphorus iron or with any largely scrap melting process for which it is not really adapted.

The Oberhausen Rotor

This consists of a horizontal, refractory lined, cylindrical vessel which can rotate at 2 r.p.m. Hot metal, lime, and ore are charged through a relatively small circular opening in one end, and two oxygen probes are inserted through a similar opening in the opposite end, one of which is bent downwards to discharge 100 per cent. pure oxygen below the metal surface, while the other supplies oxygen of about 70 per cent. purity, above the surface of the bath to burn the CO to CO_2 and thus produce a large quantity of heat.

As a result of burning the CO to CO_2 the rotor process will consume a high proportion of iron ore in the charge, up to 15 per cent. per ingot ton. The slow rotation of the vessel is designed to prevent overheating of the lining above the bath, by transferring the heat to the charge as the hot lining rotates under the liquid.

The charging opening is of necessity small; typically the 80-ton rotor at Oberhausen is 48 ft. 2 in. long, the outer shell dia. 13 ft. 1 in., and has a lining thickness of 23½ in., and concentric openings in the ends of only 23½ in. to 35 in. dia. It cannot be envisaged therefore that the rotor will develop as a scrap melting furnace.

Generally, the rotor can be tilted to an angle of 6 deg. to facilitate slagging off. Tapping is *via* a taphole in one end of the vessel.

The rotor is operated to give a rapid but constant refining speed. The primary oxygen delivered below the surface is consumed for oxidation of metalloids, but, in addition, the upward thrust of the gas bubbles produces an area of vigorous reaction at the slag-metal, and slag-gas interfaces, with the result that considerable quantities of the secondary oxygen also react with the bath to speed up the refining.

However, sufficient secondary oxygen must remain available for cumbustion of the CO above the bath. Control, that is, the introduction of a constant total quantity of oxygen into the bath

from the primary and secondary sources, is achieved by varying the depth of the primary oxygen lance in accordance with measurements of the volume of waste gas and the concentration of CO. If the secondary oxygen is being absorbed by the bath, the quantity of CO will increase at the expense of the CO_2, the waste-gas volume will fall and *vice versa*.

As the depth of immersion of the primary lance increases, the percentage CO in the waste gas rises. It is generally the practice therefore to link the depth of the lance with the waste-gas volume and CO analysis, to achieve a constant rate of absorption of oxygen by the metal bath.

The rotor will refine to steel, hot metal of any phosphorus content. A single slag is adequate if the phosphorus is low, *i.e.*, the blowing continues until the required carbon level is obtained.

If the phosphorus is high however, say, 1.8 per cent. a two-slag process must be adopted. When the bath contains about 2 per cent. C, and 0.1 to 0.2 per cent. P, a low iron, high P_2O_5 slag of percentage analysis P_2O_5, 18 to 20; Fe, 8 to 12 is removed. The Fe could be as low as 4 to 5 per cent. at these levels of C and P, but the slag is not then fluid and cannot be poured from the vessel. Under the second slag, which is retained in the vessel, the phosphorus in the steel may be reduced to less than 0.03 per cent.

A particular feature of the process is the low level to which sulphur may be reduced, *viz.*, 0.012 to 0.015 per cent.

Nitrogen, however, is not particularly low at 0.004 per cent., probably due to the use of low-purity secondary oxygen.

Lime consumption is about 125 kg/m. ton (280 lb./ton).

The tap-to-tap time is about 120 min., consisting of 15 min. charging ore and lime, 10 to 15 min. charging hot metal, 50 to 60 min. blowing, 10 min. slagging off, 10 min. tapping. The output rate therefore is similar to the Kaldo and about half that of the LD.

Very little information seems to be available with respect to the rotor lining life. It is believed to be short, and the dolomite consumption therefore high, say, in the range of 35 to 50 kg/ton steel, *i.e.* (77 to 110 lb./ton), which is higher than the open-hearth. This probably stems from the very high temperatures of the order of 2,000 deg. C. arising in the vessel as a result of the combustion of CO with oxygen, with only a very slow speed of rotation to transfer this heat to the steel bath.

The Oberhausen rotor is similar in operation and performance to the Kaldo. The same comparisons with basic-Bessemer and LD therefore apply. However, it is less capable of consuming scrap due to the restricted size of the openings in the ends.

Variations of the Bottom-blown Basic-Bessemer

The traditional air-blown basic-Bessemer process can operate only on an iron of phosphorus content of 1.8 to 2 per cent., and consumes a low percentage of scrap <5 per cent. It produces steel high in nitrogen, about 0.0012 to 0.0015 per cent., and relatively high in phosphorus, 0.03 to 0.04 per cent.

Since the war, there have been modifications in technique leading to more flexibility in usable hot-metal analysis, percentage scrap, and improvement in the quality of steel produced.

The two main developments have been the use of oxygen enriched air and of steam/oxygen. The air is now frequently enriched up to 30 to 35 per cent. oxygen. This greatly accelerates the refining speed, cutting the blowing time by as much as 40 to 50 per cent. In addition, up to 15 per cent. scrap may be charged, or, alternatively, hot metal of lower phosphorus content blown, and the nitrogen in the steel is reduced to 0.006 to 0.008 per cent.

The steam/oxygen-blown basic-Bessemer process, if air is not used during any part of the blow, has the major advantage that steel is produced with extremely low nitrogen, in fact, in the region of 0.001 per cent. This is very much lower than the open-hearth, and lower even than top-blown oxygen processes, which generally achieve 0.002 to 0.003 per cent. Such extremely low nitrogen is of considerable importance in the production of very soft ductile steel for deep-drawing sheet.

The process consumes only about 5 to 8 per cent. scrap, but the main problem is the nature of the conditions to which the tuyeres are exposed, and the resultant effect on bottom life. Approximately 50 to 60 per cent. of the life of an air-blown bottom is obtained. Heats per bottom in the range of 33 to 50 are now being achieved in the VLN plant of the Steel Company of Wales, after a great deal of development work in the techniques of bottom making and converter operation. The lining life is good, ranging from 230 to 275 heats.

There is no doubt that the quality of steel produced is eminently suitable for virtually all sheet steel requirements, including severe deep drawing, a typical percentage analysis being C, 0.045; S, 0.022; P, 0.025; Mn, 0.32; N_2, 0.0011; Cu, 0.04; Sn, 0.01; Ni, 0.04.

The cycle time per heat is 25 to 30 min., of which the actual blowing time is about 10 to 11 min. during the first blow prior to the slag off, and 30 to 60 sec. during the second blow when the phosphorus is reduced to the required level. Charging, slag off and tapping account for the remaining time. A 50-ton converter shop of three vessels, with one blowing will therefore produce at the rate of 100 ton/hr.

Comparisons Between Open-hearth LD and Arc Furnace Plants

In Table 1, comparisons of capital and operating costs have been estimated for the following hypothetical plants.

(1) *Open-hearth Plant*—Four 300-ton Maerz-Boelens furnaces of fully articulated design, operating on about 40 per cent. scrap, 60 per cent. hot metal, using oxygen under all-basic roofs both for flame enrichment and for refining from hot-

TABLE 1.—*Comparison of Capital and Operating Costs for Various Hypothetical Plants.*

	Open-hearth plant. Four 300-ton furnaces.	LD plant. Two 100-ton converters.	Arc furnace plant. Two 150-ton arc furnaces.	Combined LD+arc furnace plants. Two 100-ton converters. Two 140-ton arc furnaces.
Operating rate	Ton/hr./furnace—50	1 converter operating 133 ton/hr.	Ton/hr./furnace—25	—
Annual output (50 weeks)	1,510,000 tons	1,120,000 tons	375,000 tons	1,495,000 tons
Capital cost/annual ton	£7·85	£5·9	£9·85	£6·9
Scrap (per cent.)	40·4	30	75	41
Ingot yield (per cent.)	88	88	90	88·7
	s. d.	s. d.	s. d.	s. d.
Cost materials/ton	385 2	395 11	349 2	384 1
Conversion cost/ton	80 10	78 6	148 8	96 2
Depreciation/ton	6 3	4 9	7 11	5 7
Total ingot cost/ton	472 3	479 2	505 9 Power £3 10s. 6d./ton Electrodes £1 0s. 0d./ton	485 10

metal addition onwards. The long-term average tap-to-tap time is assumed to be 6 hr., that is, 50 ton/hr., and the furnace availability at 90 per cent.

Annual output 1,510,000 tons.

(2) *LD Plant*—Two 100-ton converters. Over the long term the average tap-to-tap cycle is assumed to be 45 min., giving an output of 133 ton/hr. Thirty per cent. scrap usage is assumed.

Annual output 1,120,000 tons.

(3) *Arc Furnace Plant*—Two 150-ton arc furnaces, equipped with 30,000 to 35,000 kVA transformers, and having an average long-term cycle time of 6 hr., that is, 25 ton/hr. The scrap usage is assumed to be 75 per cent., cold pig about 20 per cent., the remaining 5 per cent. being ore. The power and electrode consumptions are assumed to be 550 kWh and electrodes 12 lb./ton, respectively.

Annual output 375,000 tons.

It will be noted that the combined annual outputs of the LD and arc furnace plants is 1,495,000 tons, that is, very close to that of the open-hearth plant, which is 1,510,000 tons. Also, the combined percentage of scrap consumed by the LD and arc plants is very nearly the same as the open-hearth plant, that is, 41 per cent.

We therefore have a comparison for the same annual output between a fast modern open-hearth plant, consuming a percentage of scrap close to that which may arise in practice, and a combination of a modern oxygen steelmaking process using high hot metal, together with an electric arc plant bringing up the scrap to the same percentage, that is, 41 per cent.

The significant features of this comparison are:—

(1) The LD plant has the lowest capital cost per annual ingot ton—£5.9. The LD plant also has the lowest conversion cost per ton—78s. 6d.

(2) The open-hearth plant, while having a relatively high capital cost, £7.85, has a moderate conversion cost of 80s. 10d., only 2s. 4d. greater than the LD plant.

The higher percentage scrap consumed in the open-hearth plant, by virtue of the relatively low price of scrap compared with hot metal in this country, results in the total ingot cost being 6s. 11d. less than the LD.

(3) The arc furnace plant at £9.85 has a higher capital cost/annual ton than the open hearth. It has a much lower cost of materials than either the LD or the open-hearth plants, due to the high scrap percentage.

However, the conversion cost is extremely high between 70s. 2d. and 69s. 10d. more than for the other two processes. This is largely due to the high cost of power, 70s. 6d. per ton, and of electrodes, 20s. per ton.

The total ingot cost is therefore the highest of the three, 26s. 7d. per ton greater than the LD.

(4) The combination of an LD and arc furnace plants giving the same ingot output and consuming the same percentage of scrap as the open-hearth plant, has a cheaper capital cost by £0.95 per annual ingot ton, the cost of materials is about the same (since the percentage of scrap is the same), but the high conversion cost of the arc furnaces outweighs the low conversion cost of the LD, with the result that the conversion cost is 15s. 4d. greater, and the combined total ingot cost 13s. 7d. greater than the open-hearth plant.

The above comparison indicates:—

(1) The LD plant is cheapest to install and cheapest to operate.

(2) The total ingot cost of the LD plant depends on the relative prices of scrap and hot metal. In countries where these prices are nearly equal, then the LD plant will also achieve the lowest total ingot cost.

(3) The open-hearth plant can consume much more scrap than the LD, if required, and since its conversion cost is also not much more than the LD, the normal percentage of scrap which it is necessary to consume in most steelworks lowers the total ingot cost to below that of the LD, if the price of scrap is lower than that of hot metal, as in this country.

(4) The arc furnace plant suffers from a relatively high capital cost, and a very high conversion cost. Only if the price of scrap is low compared with hot metal, as in this country, is the total ingot cost reasonable. The arc furnace finds an application in the production of special steels as a sub-

stitute for the cold metal open-hearth plant, or where the price of power is very low.

(5) The LD and arc plant in combination has a smaller capital cost than the open-hearth plant, but is more costly to operate. These factors are independent of the scrap/hot metal ratio. It is therefore deduced that:

(*a*) A combined LD and arc furnace plant operating on normally occurring scrap/hot-metal burdens, is not yet a substitute in this country for a fast, oxygen-driven open-hearth plant, unless the saving in capital cost, £0.95 per annual ton, is of greater significance than the increase in conversion cost, 15s. 4d. per ton.

(*b*) An LD plant, as the principle hot metal consumer, operating in conjunction with an open-hearth plant, as the principle scrap consumer, is the most economical proposition in this country at the present time.

DISCUSSION

Some of the many questions raised in the discussion are reported below.

With regard to open-hearth and VLN processes for the production of extra-deep drawing steel, the author was asked if the fact that the former could attain a lower phosphorus content compensated for the fact that it could not achieve as low a nitrogen content as the VLN process.

Dr. Kesterton said he thought that while it was probably too early to give a definite answer to this question, the ability to remove phosphorus to very low contents was certainly a help in attaining extra-deep-drawing properties. However, the VLN process was able to remove phosphorus to below 0.02 per cent. The bottom-blown converter processes had another point in their favour, namely, that they could remove the carbon to extremely low contents. On the present experience one could say the VLN steel was as good for extra deep drawing purposes as O-H steel.

Replying to a suggestion that the rapidity of the converter processes gave less opportunity for controlling the state of oxidation of the steel at the end of refining than was obtained in the slower refining process of the open-hearth furnace, Dr. Kesterton divided his answer into two parts.

Firstly, he said, if the open-hearth process was to compete successfully with the converter processes it must use oxygen to the full and also have a very high rate of refining. The problems of oxidation control were in any case substantially the same in top-blown converters and open-hearth furnaces using roof oxygen lances. Secondly, experience with the VLN process in the bottom-blown steam-oxygen converters had shown that the state of oxidation of the steel at tapping could be controlled to within narrow limits so that the deoxidation practice gave consistent results. This was because in the VLN process the carbon content at tapping was a secondary variable because the bath was operated in the final stage of the process to remove phosphorus. The carbon content was always very low (0.02 per cent. at tapping) and the state of oxidation was therefore also consistent. The deoxidation control was therefore quite as satisfactory as for open-hearth extra-deep drawing steel.

In view of the steel sheet industries' interest in the production of high-silicon steel for transformer sheet, the question of making such steels by converter processes was raised, and Dr. Kesterton said he saw no reason why these processes should not answer such a purpose particularly as low-carbon and low-nitrogen contents were desired in such steel.

Another speaker suggested that more use should be made of the acid open-hearth furnace to produce transformer steels, this being very economical for melting of high-silicon scrap and obtaining a good yield of silicon and reducing the amount of a ferro-silicon alloy to be added.

With regard to acid steelmaking another speaker mentioned that some development work on an acid-lined Kaldo vessel had been carried out and if this was successful it would mean that by having a spare vessel with an acid lining the Kaldo process would have still further flexibility because a vessel could be changed very quickly.

The need for greatly improved lining materials for converters was stressed by another speaker who also pointed out that the greatly increased rates of steel production by the oxygen process would have to be matched by improved services in the casting and mould preparation bays.

Commenting on this latter aspect, Dr. Kesterton thought that converter processes would have some advantage over the open-hearth process because they presented small batches of steel at short but regular intervals.

Another speaker expressed the view that although the more important developments of the oxygen converter processes of the last few years had immediately threatened the eclipse of the open-hearth furnace, Dr. Kesterton had shown that the current developments in the faster working of the open-hearth furnace by use of oxygen, of improved refractories, of segmented construction for rapid repair and of new rapid methods of charging might well mean that the open-hearth furnace could produce steel as cheaply as the converter.

Dr. Kesterton agreed that until the full potential of the open-hearth furnace had been fully explored, including, for instance, the possibility of combustion of the fuel totally with oxygen, the question of open-hearth *versus* converter would remain unresolved.

CEYLON'S STEEL PROJECT

FINANCIAL aspects of the proposed Iron and Steel Industrial Corporation for Ceylon have been discussed in Ceylon by Soviet experts and an official of the Ministry of Industries. Discussions centred on the first stage of the three-part scheme, which is a rolling mill and wire goods production plant.

The project is to be sited at Homagama, about 12 miles east of Colombo.

Kargali Coal Washery

Working of the Kargali coal washery is reported to be unsatisfactory, states our Colombo correspondent. Against a capacity of 2,200,000 tons monthly, the output is only a fraction of that tonnage. The washery, put up with the help of a Japanese firm at a cost of about Rs. 18,000,000, required another Rs. 3,000,000 for its commissioning. It is the main source of coal supplies to the Rourkela and Bhilai steelworks.

Vacuum Casting

NEW STEEL TECHNIQUES AT ROTHERHAM

FOLLOWING two years of trials and research involving the production of several thousand ingot tons, a vacuum casting technique for the removal of certain impurities from steel during the ingot stage is now in commercial operation at the Rotherham works of Steel, Peech & Tozer, branch of the United Steel Companies, Limited. The company is believed to be the first in this country to make steel produced by this method commercially available.

The object of vacuum casting—or degassing, as it is sometimes called—is primarily to remove hydrogen from the steel. This can be achieved by suitable heat treatment, but in the case of comparatively large section sizes, such as medium and heavy forgings, the necessary heat treatment to remove hydrogen by diffusion may take several hundred hours to complete. By casting the steel in a vacuum, however, hydrogen removal can be accomplished in a matter of minutes.

All hydrogen levels after vacuum casting are sufficiently low to eliminate completely the need for such normal hydrogen precautions as the slow cooling of rolled blooms or the extended heat treatment of large forgings.

Properties More Regular

The oxygen content is appreciably lower than on air-cast samples, although the nitrogen content of the steel is not greatly affected by vacuum casting, only about 15 per cent. being removed on average. Carbon content tends to decrease by one or two points and sulphur is lowered by an average of 0.001 to 0.002 per cent. Alloying elements remain unchanged, and this includes manganese.

Mechanical tests have shown that the properties throughout large forgings made from vacuum cast steel are more regular and that the ductility, in particular, is good. Transverse properties are also improved. Impact properties are good and no significant difference in transition temperature has been found.

The equipment employed for vacuum casting at Steel, Peech & Tozer consists essentially of a cylindrical casing of ¾-in. thick welded steel plates. This 11-ft. dia. chamber is fitted with a removable lid having water cooled flanges, the vacuum steel being effected by a neoprene rubber gasket in the flange.

The sequence of operations begins with the positioning of ingot moulds in the vacuum chamber. The lid is then secured and the chamber is evacuated by steam ejector pumps to 0.5 mm. of mercury or 1/1500 of an atmosphere. A ladle of molten steel is brought by overhead crane to the vacuum chamber and steel is teemed through a small opening in the lid at a controlled rate.

As the steel enters the chamber, it is broken up into a fine spray due to the explosive release of gases, caused by the vacuum. It is this characteristic which enables very rapid degasification to take place, the process continuing at a slower rate when the steel is in the ingot mould. On completion of teeming, the vacuum is gradually released and the ingot allowed to cool in the normal way.

At the present time, steel for vacuum casting is being melted in a 7-ton electric arc furnace at Steel, Peech & Tozer. As an integral part of the company's £10,000,000 scheme to replace all its open-hearth furnaces with six 110-ton capacity electric arc furnaces, however, it is planned to incorporate facilities which will permit the vacuum casting of the very much larger tonnages of steel produced in these furnaces.

It should perhaps be mentioned that, for a wide range of applications, steel produced by normal casting techniques is entirely suitable with regard to the properties for which it is specified. The particular merits of vacuum cast steel are in those cases—such as large forgings—where the elimination of prolonged heat treatment cycles (necessary to ensure freedom from hairline cracks) results in much shorter delivery dates; or where, in addition to hydrogen, the removal of oxides and nitrides may lead to a cleaner steel with improved properties.

Britain Third Largest Steel Producer in Europe

BRITAIN was the third largest producer of crude steel in Europe in 1960, according to the Quarterly Bulletin of Statistics for Europe published by the United Nations. The main producers in 1960 (with figures for 1959 in parentheses) were:—USSR, 65,292,000 (59,950,000) metric tons; West Germany, 34,100,000 (25,824,000) tons; Britain, 24,695,000 (20,511,000) tons; France, 17,279,000 (15,219,000) tons. No other European country exceeded 9,000,000 tons.

Russia was also the largest producer of iron ore in 1960, with 106,541,000 (94,390,000) tons. France produced 66,911,000 (60,887,000) tons, Britain 17,362,000 (15,108,000) tons; and West Germany 13,526,000 (12,962,000) tons. The statistics are prepared by the secretariat of the Economic Commission for Europe.

New German Steel Plant

GERMAN coal, steel and engineering concern, Rheinische Stahlwerke, is planning to build an oxygen steel plant and light section mill at Gelsenkirchen. Crude steel capacity initially will be between 600,000 and 1,000,000 tons per annum, but eventually will be capable of expansion to 3,500,000 tons a year, said the company's managing director, Herr Werner Soehngen.

This project is additional to an investment programme totalling DM700,000,000 for 1961-63, which includes the erection of a power station and the extension of the group's capacity for Hamonag lorries, tractors, and building machines.

Alfred Herbert Research Centre Opened

ALTHOUGH home manufacturers would face added competition if Britain joined the European Common Market, they would also be presented with much wider opportunities, said Mr. Reginald Maudling, President of the Board of Trade, at Coventry on Tuesday.

MR. R. MAUDLING

Mr. Maudling, who was officially opening a new £250,000 applied research department at the machine-tool factory of Alfred Herbert, Limited, added that, for the machine tool industry the achievement of a home market of more than 200,000,000 people would be "a really great step forward." World markets for machine tools would continue to expand, he said, not only among the less developed countries but also in the industrialized countries themselves, such as the US, Germany, and Japan. Britain's traditional competitors, the US, Germany, and Switzerland, were pressing ahead and machine-tool industries were being developed fast behind the "Iron Curtain," particularly in Czechoslovakia and Russia.

Although individual research and development was important, the President said he attached great importance to co-operative research and he welcomed the formation of the Machine Tool Research Association. "I understand that sufficient support from the manufacturing side of the industry has been promised to secure a grant from the Department of Scientific and Industrial Research."

The new research centre is the last stage in the Alfred Herbert six-year £2,750,000 plan to expand the company's research and development facilities. Current expenditure on these activities is running at about £350,000 a year.

Plans for Expansion by Arthur Balfour

PLANS and projects for further expansion and re-equipment by Arthur Balfour & Company, Limited, the Sheffield tool steel manufacturers, are in an advanced study stage, and some of them may come to decision soon, states Lord Riverdale, chairman, in his annual review. The cost, in any case, will not fall heavily on the 1961 period and the company expects to finance the plans from its own resources. "We envisage opening new horizons of output and range of products," he says.

Export markets reveal as usual some up and down effects, he states, but overall the company's exports expanded, though to a lesser extent than the rise in home sales.

The company has inaugurated a "25 Year Club" for employees who have served the firm for this or longer periods, of which some 250 members have been eligible.

Appointments

Mr. A. H. H. YOUNG has been appointed general manager of Derby Cables, Limited, a subsidiary of Crompton Parkinson, Limited. Mr. Young will be responsible to Mr. F. D. Milner, who recently relinquished his position of general manager while remaining managing director of Derby Cables.

Mr. JIM HOLCOMBE has joined Bowmaker (Plant), Limited, machinery dealers, of Willenhall (Staffs), as used equipment export representative, and will be based at Cannock. Mr. DOUGLAS BOWMAN has joined the sales department of the company at Cannock, and will assist Mr. D. M. Speight, earthmoving representative.

Mr. DENIS FRAYMOUTH has been appointed sales manager of the Nuralite Company, Limited, a subsidiary of the British Uralite, Limited, group. He recently held a staff appointment with the War Office and for his work in connection with the reorganization of the Territorial Army was made MBE in the Birthday Honours.

Mr. J. R. DIVENS has been appointed technical representative for Scotland for W. G. Allen & Sons (Tipton), Limited, colliery, light railway, and mechanical engineers, of Tipton (Staffs), with effect from August 1. Mr. Divens is at present Area mechanical engineer in the Alloa Area of the Scottish Divisional Coal Board.

Mr. GEORGE P. THOMAS has been appointed engineer responsible for maintenance and installation of all plant at the Swansea factory of the Prestcold division of the Pressed Steel Company, Limited, and Mr. C. TAWSE has been appointed assistant plant engineer. Mr. P. A. HEWESTON becomes plant electrical engineer, and Mr. D. G. PREEDY, conveyor engineer.

Mr. W. H. TAYLOR has been appointed manager, group personnel services, Associated Electrical Industries (Rugby), Limited, and will be responsible for all personnel and associated matters, not only for the management company, but for the Rugby-managed divisions and subsidiary companies of AEI. Previously Mr. Taylor held a personnel and education appointment with the General Electric Company, Limited.

Mr. F. HOLLOWAY, at present secretary of the Workington Iron and Steel Company branch of the United Steel Companies, Limited, will become secretary and office manager from July 1, following the retirement of Mr. W. McGregor. From the same date, Mr. G. HIRD is appointed agent responsible for the company's mining and quarrying properties in Cumberland, following the retirement of Mr. J. S. Booth.

NEW PRESIDENT OF INSTITUTION OF PRODUCTION ENGINEERS

JOINT managing director of Concentric Manufacturing Company, Limited, automotive and general engineers, etc., of Birmingham, Mr. Harold Burke has been elected president of the Institution of Production Engineers for 1961-62. A member of the Institution's council since 1948, during which time he has held the offices of chairman and vice-chairman of council, he is also a past chairman of the Midlands region of the Institution.

The vice-president of the Institution for 1961-62 is Mr. R. Ratcliffe, Controller of the Royal Ordnance Factories, who has been a member of the Institution since 1948.

In Parliament

FINANCING SPENCER WORKS

No Increase of Government Loan to RTB

REFERRING to the need of Richard Thomas & Baldwins, Limited, to increase its borrowing during the next few years for its development of the Spencer Steelworks, MR. ANTHONY BARBER, Parliamentary Secretary to the Treasury, said that, as already stated by the Minister, the company would look to the Iron and Steel Holding and Realisation Agency—its usual source of finance for short term requirements—and there was no question of an increase in the amount to be advanced by the Exchequer.

MR. BARBER was replying to a question by MR. ALFRED WISE (Con.), who said that estimates for the building of the Spencer works would be considerably exceeded, and that revised estimates would be submitted with an application for an increased Government loan for more than the £70,000,000 at present agreed.

MR. BARBER, while assuring him that there was no question of an increased Government loan, agreed that the company would have to find substantial sums for its Spencer Works development and elsewhere in addition to tthe expenditure of £150,000 already referred to by the Minister.

Replying to a question by MR. GERALD NABARRO (Con.), MR. BARBER said that the current book value to the Iron and Steel Holding and Realisation Agency of its present holdings amounted to £140,700,000, of which £67,100,000 related in securities and loans to RTB. In addition, the Minister of Power had lent £12,100,000 to RTB and £15,000,000 to Colvilles, Limited, under his agreement with these two companies.

AID FOR BRITISH TIN MINES

HINT of a concession to British tin producers, with the object of encouragement for the re-opening of Cornish tin mines in times of scarcity, was given by MR. SELWYN LLOYD, Chancellor of the Exchequer, when the Finance Bill was further considered in committee. Mr. Lloyd told Mr. Harold Wilson (Lab.), and members for Cornish seats that he could make "absolutely no promise," but before the report stage he undertook to see whether there was any way he could help by some further kind of tax concession. He emphasized that tin was a special case, and anything he did would not be a precedent for all the extractive industries.

MR. WILSON said the world faced a shortage of tin, and for Britain the danger was of an absolute shortage which was needed to ensure full employment, and of a possibility of having to pay a good deal more for tin imports. In these circumstances, home production should be encouraged by special tax concessions.

FOUNDRY WORKERS SHORTAGE

FOUNDRY employers in the West Midlands had complained that although local employment exchanges were unable to find suitable workers to fill vacancies, they refused to issue labour permits for aliens, said MR. STEPHEN SWINGLER (Lab.), who asked the Minister of Labour to take urgent action to deal with the labour shortages in the foundries.

MR. PETER THOMAS, Parliamentary Secretary to the Ministry of Labour, said that regarding the particular case which Mr. Swingler had raised in a letter, the local employment exchange would try to meet the firm's requirements for foundry workers from among the unemployed in the area, but if this was not possible the Department was prepared to consider an application for labour permits for foreign workers.

RATING RELIEF FOR SHIPYARDS

WHEN the Rating and Valuation Bill was considered in Committee in the House of Lords, VISCOUNT RIDLEY moved a new amendment to provide rating concessions for dry docks, floating docks, slipways, and other structures connected with shipbuilding. He said there was intense competition and Britain had to fight to keep the shipbuilding industry going. A dry dock was an expensive piece of plant and local authority services could do nothing towards its efficient running.

LORD LATHAM, opposing the proposal, said that if there was a responsibility it belonged to the nation as a whole, and any assistance given to the depressed industries should be given by the State and not by the local authorities.

COAL AND THE COMMON MARKET

SUGGESTION by DR. ALAN THOMPSON (Lab.), that a small committee should be set up to examine the possible effects on the coal industry of Britain's entry into the Common Market was rejected by MR. RICHARD WOOD, Minister of Power.

MR. WOOD said that all aspects of British membership of the Common Market would be carefully examined before there was any decision to enter into negotiations with the European Economic Community or the European Coal and Steel Community, and he saw no need for such a special committee.

IN A WRITTEN answer to Mr. Frederick Lee (Lab.), the Parliamentary Secretary to the Ministry of Labour said that the Iron and Steel Trades Employers' Association had asked the Minister of Labour to consider appointing a committee to inquire into a dispute concerning the pay of craftsmen employed by firms in membership of the association, but the Minister had suggested the employers and unions meet again at national level to discuss the dispute. Such a meeting was being arranged.

Board Changes

Mr. A. Parramore Succeeds Brother as Chairman

ONE of the original members of the firm founded in 1904 by his father, Mr. Alfred Parramore has been appointed chairman of F. PARRAMORE & SONS (1924), LIMITED, ironfounders, and manufacturers of pipes and gutters, etc., of Chapeltown, near Sheffield. Joint managing director of the company since 1924, he succeeds his brother, Mr. Ernest Parramore, who died recently.

Son of the former chairman, Mr. E. F. G. Parramore becomes managing director. He joined the company is 1929 as metallurgist and was appointed general manager in 1939. Mr. Tom Edley, who joined the firm as an office boy when he was 15, has now been appointed company secretary.

D.P. BATTERY COMPANY, LIMITED—Mr. N. L. Howell has been appointed to the board.

FIRTH CLEVELAND, LIMITED—Mr. Gordon Harries, secretary, has been elected to the board.

BRITISH METAL CORPORATION, LIMITED—Mr. R. Dennis Poore has been appointed a director.

QUALCAST, LIMITED—Mr. H. Clarke has been appointed assistant managing director as from July 1.

ARMSTRONG WHITWORTH (PRESSINGS) LIMITED—Mr. W. Gibbons, works manager, has joined the board.

BRUCE PEEBLES & COMPANY, LIMITED—Mr. R. W. Flux has joined the board.

MONCKTON COKE & CHEMICAL COMPANY, LIMITED—Mr. John Gallagher, general manager, and Mr. James Woodhouse, sales manager, have been appointed directors.

PLATT BROS. & COMPANY (SALES), LIMITED—Managing director, Mr. S. C. Seward, has been appointed chairman of Dobson & Barlow, Limited, machinery sales.

WILLIAM DOXFORD & SONS (ENGINEERS), LIMITED—Mr. T. W. D. Abell has been appointed managing director as from August 1. He will also be on the board of the holding company, Doxford & Sunderland Shipbuilding & Engineering Company, Limited.

NATIONAL UNION OF MANUFACTURERS ADVISORY SERVICE, LIMITED—Mr. G. L. Page has resigned as managing director, but will continue as a consultant. He is succeeded by Mr. G. A. Hutcheson. Mr. O. R. J. Lee has been appointed an executive director. Mr. H. J. Gray, a director of the National Union of Manufacturers, Inc., has been elected to the board of NUMAS.

GREEK DEVELOPMENT OF LIGNITE RESOURCES

SUCCESS of the Greek Government's policy for the development of the country's lignite resources has been announced by the Minister of Industry, Mr. N. Martis. In addition to the large deposits already located, including some 280,000,000 tons at Ptolemais already being exploited, and a further 400,000,000 tons in the Megalopolis area of the Peloponnese on which further industrial plans are being based, investigations have located a large new lignite field in the Florina area.

Savings on imported fuels resulting from the use of Ptolemais lignite for the production of electric power already run into millions of dollars, and in time the total saving is expected to reach $20,000,000 annually.

European Coal Output

THE appended figures relating to coal output and imports are taken from statistics issued from Geneva by the Coal Committee of the Economic Commission for Europe.

Tonnages are metric, and the number of underground workers employed relates approximately to the end of the month.

TABLE 1.—*European Coal Output (Metric Tons) and Employment.*

Country.	Output.		Underground employment.	
	March, 1961.	February, 1961.	March, 1961.	February, 1961.
Belgium	2,076,000	1,863,000	74,000	76,000
France	4,782,000	4,532,000	122,000	123,000
Italy	64,000	56,000	—	—
Netherlands	1,242,000	1,019,000	28,000	28,000
Poland	9,489,000	8,631,000	216,000	216,000
United Kingdom	19,118,000	15,645,000	463,000	465,000
Spain	1,228,000	1,111,000	—	—
Western Germany	12,681,000	11,404,000	294,000	296,000

TABLE 2.—*European Solid Fuel Imports in March*, 1961, *with Figures for February*, 1961, *shown in Brackets (Metric Tons).*

Importing country.	Coal and patent fuel.	Coke.	Lignite and brown coal briquettes.
Austria	311,000	54,000	19,000
	(286,000)	(55,000)	(41,000)
Belgium	345,000	27,000	7,000
	(298,000)	(24,000)	(10,000)
Denmark	255,000	27,000	11,000
	(271,000)	(119,000)	(18,000)
Finland	181,000	11,000	—
	(126,000)	(7,000)	(—)
France	892,000	508,000	41,000
	(933,000)	(467,000)	(44,000)
Greece	27,000*	1,000*	—
	(16,000)	(2,000)	(—)
Eire	154,000*	—	—
	(143,000)*	(1,000)*	(—)
Italy	792,000	8,000	14,000
	(826,000)	(11,000)	(20,000)
Luxembourg	19,000	359,000	11,000
	(20,000)	(324,000)	(12,000)
Netherlands	515,000	22,000	31,000
	(653,000)	(44,000)	(14,000)
Norway	30,000*	42,000*	—
	(34,000)*	(41,000)*	(—)
Portugal	29,000	21,000	—
	(32,000)	(6,000)	(—)
Sweden	90,000	43,000	—
	(121,000)	(66,000)	(3,000)
Switzerland	146,000	21,000	19,000
	(106,000)	(26,000)	(19,000)
United Kingdom	—	—	—
	(—)	(—)	(—)
Western Germany	548,000	18,000	307,000
	(494,000)	(19,000)	(299,000)

* Secretariat estimate.

Mining Review Goes to Ghana

"GOLD by the handful" is being taken out of the goldmines in Ghana, but there's a catch, as the July issue of "Mining Review," the NCB's newsreel shows. One ton of "muck" produces only 1 oz. of gold. Mining conditions, operations, and the machinery used, however, are much the same as those used for mining coal in the UK.

The newsreel also takes the viewer behind the scenes at the works of the Wilkinson Sword Company, Limited, big coal users, and to Wales where Howard Winstone is seen preparing for his recent featherweight championship fight.

Steel Stocks Rise

INCREASE OF 2 PER CENT. IN FIRST 1961 QUARTER

STOCKS of finished steel held by consumers and merchants increased during the first quarter of 1961 by an estimated 92,000 tons, or 2 per cent., the Iron and Steel Board stated last week. This compared with an increase of 200,000 tons during the first quarter of 1960. There is no significant change in the consequential estimate of the use of steel in the home market in the quarter, which remains at an increase of 1½ per cent. above the use in the first quarter of 1960.

Stocks held at the end of March almost regained the peak reached in the first quarter of 1958, although they now support a rate of use of steel greater than it was then, states the board.

A large part of the total increase in the quarter was accounted for by merchants' stocks which rose by 65,000 tons, or 14 per cent., to 529,000 tons. Within the stocks held by users, steel sheet showed a reduction of 69,000 tons, or 9 per cent., to 689,000 tons, while stocks of plate rose by 58,000 tons, or 9 per cent., to 700,000 tons. Stocks of tinplate rose by 4,000 tons to 166,000 tons, while stocks of other products held by users, representing over half the total of consumers' and merchants' stocks, showed little change.

Western Australia Seeks Industrial Development

LEADING industrialists and businessmen in the UK have received a report drawing attention to the opportunities available in Western Australia for the development of new industries. The report is the result of steps being taken by the Western Australian Government to increase the industrial development of the State and has been circulated by Sir Russell Dumas, who is in this country as member of the State's Industries Advisory Committee to encourage the further participation of British industry there.

Last year, at the invitation of the Western Australian Government, a team of nine UK industrialists, headed by Mr. J. O. Knowles, a director of Metal Industries, Limited, visited the State and the team's subsequent observations resulted in the report which has been sent out. Among the many investment possibilities suggested is the establishment of a chemical engineering industry which would encourage further processing before export of many of the country's abundant raw materials.

There are possibilities, too, says the report, of development for automobile components, agricultural implements, electrical engineering, electric motors, and medium ranges of internal combustion engines.

It is a remarkable substantiation of the confidence conveyed by the authors of this report that, since their visit, agreements have been made, or are in the course of negotiation, for projects with a total value of £104,100,000. Tenders have been called for the purchase of 17,000,000 tons of iron ore, f.o.b., to the value of £58,000,000.

Production Plan for New Ghent Steel Unit

GIVING brief particulars of Sidemar, the new integrated steel unit near Ghent, M. Toni Neuman, chairman of the board of Arbed, the Luxembourg steel company, on Monday confirmed that in addition to Arbed Forges de la Providence and Cockerill-Ougrée, the French group Schneider (Le Creusot) would participate. The initial capital will be fcs. 5,000,000,000, of which Arbed will subscribe a third, but the proportion will be only 25 per cent. when the capital is raised to fcs. 9,000,000,000.

Sidemar is expected to be in production within three years with an initial output of 1,500,000 tons yearly, which later will be raised to 2,500,000 tons. The end-product will be thin steel plates. Fully integrated, the plant will include two blast furnaces of 9-metre crucible diameter. The three 725-ton and three 125-ton converters will be equipped for steelmaking by the LD process which has been adapted and developed by Cockerill-Ougrée at Seraing.

Sidemar will produce its own oxygen and, in addition, Arbed is setting up its own oxygen unit at Esch-sur-Alzette, which will be the central source for the company's works in Luxembourg and the Saar.

Better Steel Supplies Outlook for Ambrose Shardlow

CHAIRMAN of Ambrose Shardlow & Company, Limited, manufacturers of drop forgings and crankshafts, of Sheffield, Mr. F. A. Perkins, says in his report on the year to March 31, 1961, that regarding steel supplies the forward outlook is somewhat better and "our steelmakers tell us they should be able to supply all our needs during the current year." Last year the company was obliged to purchase steel on the Continent, incurring higher prices and import duty.

Mr. Perkins reports the recent conclusion of an agreement with the Rootes group to supply all the finished crankshafts for its new Scottish project. As the present factory in Sheffield has little room for further expansion, the company is acquiring a site on the North East Coast to accommodate a new machine shop of some 30,000 sq. ft. to cope with this new contact.

There is an undertaking to subscribe £125,000 in the capital of Shardlow India.

The Scrap Markets

Steelworks Are Relying on Stocks

TENDENCY on the part of some steelworks to rely mainly on their own scrap arisings and ample stocks has resulted in a marked decrease in the orders for steelmaking scrap being issued to merchants. They in turn have been obliged to reduce considerably their own collection and processing machinery.

The unloading of 7,300 tons of scrap iron at Rotterdam in 2½ days has set up a new record for the port. At the time four other ships were also unloading, bringing the number of arrivals of ships in this trade up to 11 since the beginning of June.

Cleveland—In several cases steelworks are taking no deliveries at all for the present and at other works the intake is intermittent, the tonnages ordered being small in comparison with the quantity of scrap available.

Foundries remain fairly busy, largely on orders from the engineers and are taking a fair amount of the heavier grades of cast-iron scrap. With the present rate of pig-iron production still considerable, baled scrap for blast-furnace use is well supported.

Glasgow and the West of Scotland—Business continues fairly satisfactory. Annual holidays, however, are approaching, and this will, within the next two weeks, cause the usual seasonal drop in the amount of scrap tonnage available. The steelworks are continuing to accept all available deliveries of heavy steel and basic scrap. There have been isolated instances of partial closures due in the main to congestion of traffic, but there is still little or no difficulty experienced in disposing of scrap tonnage as it arises.

The output of steel turnings is being well maintained, and regular consignments are going forward to the consuming works. The production of cast-iron borings is well up to average for this time of year, and an ever-open door is provided by the blast furnaces.

South Wales—Steelmakers and ironfounders throughout the area are carrying heavy stocks of scrap on the ground. Many of the local works are refusing deliveries of any scrap and the steelworks still open to receive supplies are limiting these very much indeed, accepting only the grade and quality they wish to receive.

Merchants are finding the position increasingly difficult and stocks which they carry on their yards are not moving. The agreement which had existed to divert surplus scrap to the Scottish area ceased on May 31 and this has worsened the position. The market is very quiet.

Quicker Information on Stock Changes

FOLLOWING discussions with the Association of British Chambers of Commerce, the Federation of British Industries, and the National Union of Manufacturers, the Board of Trade is making an appeal to industrial firms to do what they can to send the statistics they provide to the Government, and particularly statistics of stocks, as quickly as possible.

Sir Richard Powell, Permanent Secretary to the Board, has written personally to the chairman of some 800 companies contributing to the Board's inquiries into manufacturers' stocks.

Sanderson Kayser Plant Replacement Plans

IN his review for 1960, Mr. J. R. A. Bull, chairman and managing director of the Sanderson Kayser, Limited, group of steelmakers, etc., of Sheffield, states that a comprehensive survey of the group's steel melting facilities has led to the placing of contracts for new melting furnaces. Two 12 cwt. high frequency induction melting furnaces are to be replaced with a furnace of 1 ton capacity, powered to give very rapid melting. It is estimated that the melting time per charge for the new furnace will be only 50 per cent. of that taken at present and should lead to substantial economies.

A 10-ton arc furnace has been ordered and it is expected that this will prove in due course more efficient in production than the existing 4-ton and 3-ton furnaces. A contract has also been placed for an important addition to the centreless grinding capacity of the group.

Mr. Bull also states that the amalgamation during the year of Sanderson Bros. & Newbould, Limited, and Kayser Ellison & Company, Limited, has led to much useful co-operation and interchange of information. The benefits can be expected to increase in future years as all plant extensions are being planned on a group basis.

French Steel Industry Seeks Rise in Prices

RISE in French steel prices is strongly urged on the Government in the annual report of the French producers' association. French steel, since revaluation of the Deutschmark, has been about 15 per cent. cheaper than German, but the report shows that in spite of this price advantage French steel exports went up hardly at all between 1959 and 1960, while imports rose by 64 per cent. The French industry is reported to be contemplating a price rise of about 5 per cent.

The next four-year national plan foresees an increase in steel production from 17,300,000 tons in 1960 to 24,900,000 tons in 1965, and the report says that the new investments needed to bring about such an increase will entail total charges of 12,000,000,000 fcs. (£860,000,000) over the next five years. This programme must be partly financed by a rise in prices.

Report on Russian Machine Tools

BACK in the UK after a tour of Russian factories, 42 British experts, members of the British Gauge and Tool Manufacturers' Association, said the picture Russia has painted for the outside world is "daubed with the broad brush of propaganda."

Although the Russians were well out in front in electro-erosion techniques and in the use of ultrasonics, in overall operating efficiency, they were a far cry from what they claimed to be.

CONSTRUCTION OF the first Indonesian steelworks, with an annual capacity of 100,000 tons, will begin this year at Merak, Java. The works have been designed by Russian engineers, and the USSR will supply equipment, under a 12-year credit agreement.

IRON AND STEEL TRADE

Price Changes Imposed

THE increase in the prices of iron and steel has not exactly been received with jubilation, it being held in some quarters that the rise will not even cover one third of the total increase in production costs since last September. Also it has come at a time when the market for most steel products is so easy that considerable short-time is being worked in the finishing trades and there is a movement to relate both pig-iron and crude steel outputs to the reduced ingot demands of the rolling-mills.

The Iron and Steel Board's price determination permits an increase of 1 per cent. on all classes of iron coming within the preview of the board, and this is in general being added to invoices, although one maker of foundry irons is understood to be making no increase for the time being.

Cylinder and refined irons, which are not scheduled by the Iron and Steel Board, have been raised 5s. a ton, with effect from June 19.

Pig-iron

There is now no shortage of any grade of pig-iron and most makers could, and would be happy to step up present tonnages. One or two brands of the low phosphorus irons are limited in production, but from overall outputs there are tonnages to spare. Hematite is plentiful and refined grades can be obtained without difficulty.

Makers of high phosphorus irons are seeking oversea outlets for their excess tonnages, but orders are not too easily come by.

Ferro-alloys

Ferro-tungsten is receiving fairly steady attention at present, and both ferro-molybdenum and ferro-vanadium are active. In general the demand for ferro-silicon is maintained, and interest in ferro-chrome is at a good level. There is a fair demand for calcium silicide, ferro-manganese, and ferro-niobium.

Semi-finished Steel

The demand for the products of the re-rollers shows no appreciable change. Reinforcing rods and bars are most heavily in demand, but there is only a moderate call for small bars, light sections, and strip.

Mild steel semis are in good supply and home steelworks are unable to dispose fully of the tonnages available. Carbon and alloy steel billets are now more plentiful.

Finished Steel

The demand for sections and joists is still well below normal, but makers are maintaining production by including more sizes in their weekly rollings. With plate output from new plant increasing, makers are concentrating on reducing existing obligations and are able, in some instances, to accept new business for fairly quick delivery.

Capacity is available in either current or forward programmes for cold reduced sheets and strip, galvanized sheets, either flat or corrugated, and good commercial quality bright drawn bars.

Prices of colliery steels are under review. Meanwhile, the authorized 1 per cent. is being added.

Ore Chartering

OPEN market chartering from the Mediterranean area to the Continent is quiet and, although there is some inquiry, nothing has recently been reported fixed. This position also applies from Sweden, but, on the other hand, there does appear to be rather more interest on the part of charterers to secure tonnage from usual West African ore ports for continental discharge and, possibly for reasonably early loading tonnage, owners might be able to secure some small improvement on last paid.

Some activity has, however, been reported from the Indian ports, Cuddalore/Yugoslavia fixing 11,500 tons for June 15/July 10 at 55s. f.i.o. and trimmed; Marmagoa/Adriatic, 46s. f.i.o. for 9,000 tons, July; and to Japan 9,500 tons to Moji-Chiba Range at 50s. f.i.o.t. for July 20/August 10. Some chartering is reported from Abou Zenima, 3,300 tons being fixed to Antwerp at 40s. gross terms for prompt, and a 2,400 tonner to Bilbao also at 40s. but f.i.o. basis for June 18/25, and it is reported 38s. has been paid for large size to Ymuiden or Amsterdam.

In the pyrites section 6,500 tons has been fixed from Morphou Bay to East Coast UK at 40s. on gross terms for July 5/25 and 9,500 tons to Dunkirk July 1/15 at 32s. Vassiliko Bay/Rotterdam paid 27s. 6d. for 3,500 tons June 22/July 7. There is some inquiry from Huelva to the Continent and some interest to the UK. Casablanca phosphate to the UK is quiet, but 5,500 tons has been fixed to Riemme at 25s. 3d. on gross terms for late June/July and from Tampa 10,000 tons has been taken to Formosa at $11 f.i.o.t. for June shipment.

W. H. Allen Seeks Answer to World Competition

ALTHOUGH the manufacturing capacity of W. H. Allen, Sons & Company, Limited, mechanical, hydraulic, and electrical engineers, of Bedford, will be fully occupied during 1961, the order-book is now less full than 12 months ago, reports the chairman, Mr. W. K. G. Allen. He points out that the order-book position must be expected with the increasing world competition and shorter deliveries.

The company's efforts on research, design, and productivity, are directed to better products at lower costs, he adds, and the results of these efforts will go some way towards meeting the keener international competition that lies ahead.

Mr. W. S. HORWOOD has been appointed assistant education and technical officer to the Institution of Production Engineers.

Coalfield News

Investigation Into Cortonwood Colliery Mishap

EXPRESSING deep sympathy for the relatives and friends of the dead men, Mr. John C. George, Parliamentary Secretary to the Ministry of Power, informed the House of Commons on Wednesday that of the nine men involved in an outburst of gas at Cortonwood Colliery, Wombwell (Yorks), on Tuesday four had succumbed. Investigations were proceeding. HM Inspectors of Mines were on the scene soon after the accident and further steps, if any and if necessary, would be decided on in the light of the investigation.

It is understood that nine men were working at the face of the Silkstone Seam when the mishap occurred. Four recovered and a fifth received hospital treatment. Rescue teams worked through the night to recover the bodies of the four who died.

ABOUT 2,000 South Wales miners in the Ogmore Valley (Glam), are to increase their contributions to the funds of the 100-year-old Rest Convalescent Home, Porthcawl, by one penny to twopence a week.

FOLLOWING THE first stoppage for 20 years, the 250 employed at the Waterloo Pit, Oakdale (Mon), who went on strike at the end of last week over the breakdown of underground machinery, returned to work on Monday.

A CERTIFICATE, a cheque, and Premium Bonds have been presented by the Durham Divisional Coal Board (the colliery consultative committee) to Mr. Owen Gilmore, an overman at Easington Colliery, who rescued a miner caught by a fall of stone.

OVERALL PRODUCTIVITY in the Durham Division of the NCB reached an average of 23.42 cwt. per manshift in the 23rd week of the year, against 21.46 cwt. in the corresponding week of 1960. At the face, productivity was 66.80 (63.86) cwt. per manshift.

BECAUSE ITS reserves of coal are worked out, Wheatsheaf Colliery, Pendlebury, near Manchester, is being closed. The last production shift at the 115-year-old pit was worked last Friday. There will be no redundancy among the 270 men employed at the colliery.

AT THE MANSFIELD (Notts), inquest on Mr. Roman Kos (42), a miner who was fatally injured by a fall of roof at Mansfield Colliery last Friday, the jury returned a verdict of Accidental Death. Witnesses were unable to give an opinion as to the possible cause of the fall.

COAL SHIPMENTS from the port of Blyth have increased by 68,718 tons over the figure for May last year. For the first five months of this year, shipments were 2,976,129 tons, an increase of 450,975 tons on 1960. Foreign exports to the end of May also increased to 317,826 (295,437) tons.

AN OPEN-CAST COAL SITE at Great Wyrley, near Cannock, is to close soon and within two years the excavations will have been filled in and the land reinstated for agriculture. The site has been in operation for four years and has produced between 300,000 and 400,000 tons of coal.

ACTING SECRETARY of the newly-formed National Union of Winding Enginemen, Mr. Charles Guest, said after returning from a recruiting drive in Scotland that the union's membership had now risen to over 1,100. New members acquired in Scotland were 300, he said. Next week he will visit Durham to continue his campaign.

OUTPUT RECORDS at Maltby Colliery, Rotherham (Yorks), have been broken four times in a week. On June 9 the pithead tonnage output record went up to 5,969 tons. This figure was increased on June 13 to 5,998 tons and the next day it rose to 6,287 tons. On June 15 a record of 6,417 tons was established, an increase of 500 tons on the old figure.

AS A RESULT of five test cases heard last week, more than 1,000 day-wage surface workers in the Doncaster Area of the North-Eastern Divisional Coal Board, who were involuntarily involved in the Yorkshire miners' strike last February, are to be granted unemployment benefit. It has been held that the rule barring strikers from unemployment benefit does not apply to them.

Co-ordinated Policy for Fuel "Desperate"

NEED for a co-ordinated fuel and power policy was "desperate," Mr. George Woodcock, general secretary of the Trades Union Congress, told Yorkshire miners at their annual demonstration and gala at Pontefract on Saturday. "It is foolish, fantastic, to go on with coal as a separate industry, with gas a separate industry, with electricity a separate service—and with oil outside them all," he said. "No sensible trade unionists can come to any other conclusion than that the sensible thing is to co-ordinate these industries." The choice, he said, was between competition and co-operation, and the trade union movement must continually press the Government to adopt the latter policy.

Mr. S. W. G. Ford, president of the National Union of Mineworkers, criticized the Government's attitude that the mining industry must fend for itself. It would be unwise, he said, to allow the nation's industrial activity to be dependent on foreign oil. Diminishing manpower, however, was a greater threat to the pits even than oil. Far too many were leaving the industry and too few recruits coming in, and if the trend continued the industry's efficiency would be impaired.

Mr. Ford said that much of the market lost by coal to oil a few years ago was not lost because of lack of efficiency or economy in mining, but because the industry could not guarantee to produce coal of the quantity and even of the quality which the public required.

Mr. F. Collindridge, general secretary of the Yorkshire Area of the NUM, said that if there was to be out-and-out competition between various fuels, miners had to press on together with the National Coal Board with schemes of mechanization. "Of course there have to be safeguards, but there has to be sensible and economic use of machinery which, if coal is to compete with opposing agencies, will have to be used to the fullest extent."

A resolution was passed noting "with alarm" the proposal by the Steel Company of Wales, Limited, to import American coal.

NEW COMPANY, called Pulsonic, Limited, which will specialize in ultrasonic welding, has been jointly formed by the Derritron Electronics, Limited, group, and Darlington Chemicals, Limited. Initial work will be carried out at Darlington (Co. Durham) and High Wycombe (Bucks). Directors are: Mr. V. G. P. Weake, chairman of Derritron Electronics; Mr. D. J. Grant, director of Darlington Chemicals; Mr. R. O. H. Bull, Mr. C. T. Chapman, Mr. G. P. Kirk, and Mr. P. Ritchie.

THE COAL TRADE

SOME ordering of small quantities to keep pace with the vagaries of the weather is reported from most areas, but, by and large, trade is quiet. Merchants are finding that, as yet, there has been no marked response to the campaign to stock household fuels, but it is felt that the widespread publicity is bound to have a good effect. The pattern of industrial demand remains normal and deliveries are satisfactory.

SOUTH-WEST LANCASHIRE

There has been a slight increase in the demand for household coals, due mainly to broken weather conditions and, compared with last year the position is slightly better. There is still no real response in regard to stocking. Supplies from the collieries are flowing normally and there is no difficulty in obtaining current requirements—the only slight shortages being in the lower grades of coal, particularly group 6.

Smokeless fuels are receiving slightly more attention and deliveries of Coalite, Rexco, Warmco, and other qualities are available fairly promptly. Some little stocking has now started at the depots but this is not expected to amount to any large tonnage until probably July or August. The coke market continues without any marked change and little interest is as yet being shown in stocking for domestic or central heating purposes. There is, however, a steady demand for sized coke for engineering and general industrial use and supplies of both hard and gas coke graded qualities are adequate for present needs.

Deliveries of other industrial fuels are being maintained up to the full allocated tonnages.

Average prices (per ton) of domestic coals are as follow:—Group 1, 192s. 8d.; group 2, 173s. 3d.; group 3, 156s. 5d.; group 4, 144s. 8d.; group 5, 131s. 7d.; group 6, 121s. 5d.; group 7, 107s.

YORKSHIRE

The warm dry weather has checked the spurt experienced last week in the retail market, and merchants are able to deliver most types of domestc fuel, although no surpluses are evident except for poorer qualities. Collieries, with the start of the holidays, have not been able to build up any stocks worth speaking about, and have in fact lifted some of the stock they had on the ground a week or two since.

The anthracite position continues to be very difficult, and merchants have not been able to put down stocks. Concern is felt about next winter's position unless more of this type of fuel is made available.

In the industrial market, all types of graded fuels have been in demand, and with the exception of untreated smalls, which have shown small surpluses, nothing has been put into stock.

W. G. I. Raises Dividend and Plans More Capital

CONTRACTORS for gas works and coal handling plants, etc., W.G.I., Limited, Manchester, is raising its dividend for the year to March 31, 1961, and announces proposals for the conversion of the participating capital and for scrip and rights issues. A final of 17½ per cent. on the existing £235,852 ordinary makes a total dividend of 22½ (20) per cent. Holders of the £99,805 10 per cent. non-cumulative participating preference receive a higher 12½ (12) per cent. total.

Group net profit last year rose to £202,178 (£128,680).

Coal Output and Stocks

OUTPUT of saleable coal last week at 3,920,200 tons showed a slight fall over both the previous week and the comparable period last year, and total production so far this year is now running at 4,100,000 tons less than a year ago. Consumption for the 23 weeks up to June 10 was 92,720,000, compared with 94,346,000 tons for the similar period in 1960.

Undistributed stocks, at 23,167,000, showed little change from the previous week, and remain at some 10,000,000 tons less than a year ago. Consumers' stocks continue to rise and at 13,782,000 tons show 1,000,000 tons' increase on last year.

There were 571,100 wage-earners on colliery books on June 10, against 602,380 on June 11, 1960, the numbers engaged at the coal face being 214,020 and 230,260 respectively. Total absenteeism (all workers) in the week ended June 10 was 14.1 per cent., compared with 16.2 per cent. in the week ended June 11, 1960. Output at the face was 4.182 tons and overall 1.457 tons in the week ended June 10, compared with 3.799 and 1.298 tons in the week ended June 11, 1960.

The following table gives (in tons) the provisional figures of output of saleable mined coal by division in the week ended June 17, and the tonnage lost through disputes:—

Division.	Week ended June 17, 1961.		Week ended June 18, 1960.
	Total output.	Tonnage lost.	Total output.
Scottish ..	366,000	—	360,000
Northern (N&C) ..	243,000	—	249,000
Durham	465,000	—	471,000
North-Eastern ..	851,000	4,000	805,000
North-Western ..	248,000	—	276,000
East Midlands ..	861,000	54,000	848,000
West Midlands ..	281,000	—	282,000
South-Western ..	365,000	—	407,000
South-Eastern ..	28,000	—	32,000
Great Britain—			
Deep-mined coal ..	3,708,000	58,000	3,730,000
Other deep-mined (including licensed mines) ..	43,000	—	43,000
Open-cast coal ..	169,000	—	165,000
TOTAL ..	3,920,000	58,000	3,938,000

SEVERAL LARGE new orders from the North of Scotland Hydro-Electric Board are expected by the Glenfield, Limited, group of companies. The board has already placed orders worth £2,500,000 with the group and last Friday at a luncheon in Kilmarnock, to commemorate the opening of the group's new £100,000 hydraulics laboratory, Lord Strathclyde, the chairman, said that other orders would follow. Only by laboratory research, he added, could British industry keep abreast, or in advance of, the times.

Obituary

SIR HUGH WARREN

DIRECTOR of Micanite & Insulators Company, Limited, and of British Industrial Plastics, Limited, Sir Hugh Warren, who has died at the age of 69, spent a lifetime in industry and was engaged particularly on the scientific side. Educated at Christ Church School, and at the Merchant Venturers' Technical College, Bristol, he graduated in physics at Bristol University, and from 1907 to 1911 was a demonstrator in chemistry and physics there.

He then joined the British Thomson-Houston Company, Limited, where he ultimately became director of research, holding the post for 24 years. From 1911 to 1947 he was director of engineering and managing director. From 1948 to 1954, when he retired, he was managing director of Associated Electrical Industries, Limited. He had also been on the boards of the Metropolitan-Vickers Electrical Company, Limited, the Edison Swan Electric Company, Limited, and other associated undertakings, including the Switchgear Testing Company, Limited, and Siemens Bros. & Company, Limited.

He wrote considerably on electrical installation and ignition, and also made a special study of synthetic resins. In addition to his doctorate of science, he was also an M.Sc. (Engineering), and a Fellow of the Institute of Physics. He was knighted in 1951.

The death occurred recently at the age of 65, shortly before he was due to retire, of Mr. JOHN HENRY WHIPP, undermanager at Grime Bridge Colliery (Lancs).

Founder of George H. Alexander Machinery, Limited, machine tool manufacturers, of Birmingham, in 1896, Mr. GEORGE H. ALEXANDER has died at the age of 96. He remained chairman and managing director of the company until his retirement in 1957.

Mr. MATTHEW MACFARLANE, former sales manager (technical) of Glenfield & Kennedy, Limited, valve manufacturers and hydraulic engineers, of Kilmarnock, died recently. He spent 53 years with Glenfield & Kennedy, and received a 50 years' service gold medal in 1957. He retired last October.

Mr. ERNEST BINGHAM HODSON, who was for 53 years with the Staveley Coal & Iron Company, Limited, until his retirement 12 years ago, has died at the age of 76. He was an engineer with the company for many years, and was a National Coal Board consultant in connection with the nationalization of the industry in 1947.

New John Brown Subsidiary

SUBSIDIARY, Cravens (Machines), Limited, has been formed by John Brown & Company, Limited, to undertake the machine building activities previously carried on by Cravens, Limited, engineers and rolling stock manufacturers, of Sheffield.

The board of the new company is Mr. Eric Mensforth (chairman), Mr. J. E. Owston (managing director), Lord Aberconway, Mr. R. J. Barclay, Mr. L. Creighton, Mr. K. G. Johnston, and Mr. H. Booker (secretary.

Another Successful Year for Worthington-Simpson

IN his first statement as chairman at the annual meeting of Worthington-Simpson, Limited, manufacturers of pumping machinery, brass and iron castings, etc., of Newark (Notts), Mr. P. B. H. Brown reported a net profit of £519,023 (£476,051) for the year ended December 31, 1960. The company, he said, sold a record number of units of standard ranges of equipment and output of these was 20 per cent. up on 1959.

By economies resulting from greater output and improved manufacturing methods, price increases have, generally, been avoided, but it is feared that profit margins must shrink. The present order-book, however, is in a very satisfactory state and the board felt justified in recommending a final dividend of 15 per cent. to make 25 per cent. for the year.

More Home Orders for Industry

MAJORITY of the industrial managements questioned by the Federation of British Industries, report a significant revival of new orders, more from home than from export customers. They state that output is now rising and that they are more optimistic about the general business outlook than they were four months ago, at the time of the previous inquiry, when the majority were distinctly gloomy.

Once again, skilled labour, rather than lack of orders, is the main obstacle to rising output, and production costs per unit of output are clearly rising. Prices are beginning to be raised in the home market and non-competitive prices are described as the chief impediment to larger export. Nevertheless, a majority of the firms say that the volume of new export orders has been rising and is expected to rise further, though much business has to be taken at low prices.

Recent Wills

THORP, R. A., chairman and managing director of J. Thorp & Son, Limited, steel plate workers, of Derby ... £39,242

WILSHAW, JABEZ, mines manager of Joseph Morton, Limited, makers of refractory materials, of Halifax ... £1,857

MILLARD, E. A., secretary and a director of F. Pratt & Company, Limited, lathe chuck manufacturers, of Halifax ... £7,295

FISHER, R. B., purchasing manager of Richard Thomas & Baldwins, Limited, and a qualified mining engineer ... £22,292

APTHORPE, W. H., deputy chairman and former managing director of the Cambridge Instrument Company, Limited ... £207,267

MOORFIELD, S. H., former head of the engineering department of the Wigan and District Mining and Technical College ... £5,580

CHARLESWORTH, N. H., a director of Bradley & Craven, Limited, brick and tile machinery manufacturers, of Wakefield (Yorks) ... £11,488

SHORT, H. S., former chairman of Short Bros., Limited, shipbuilders, of Sunderland, and a grandson of the founder of the company ... £19,847

CROFT, SIR ARTHUR, chairman of Crofts Engineers (Holdings), Limited, and a leading figure in the heavy engineering industry for many years ... £253,521

MARSTON, LT.-COL. G. S., co-founder of J. G. Statter & Company, Limited, switchgear manufacturers, of Amersham (Bucks), and a former chairman of Lancashire Dynamo Holdings, Limited ... £256,158

TULIP, W. L., chief engineer of the No. 2 (Mid-East) Area of the Durham Divisional Coal Board until retiring last September and formerly with Lambton, Hetton & Joicey Collieries, Limited ... £26,721

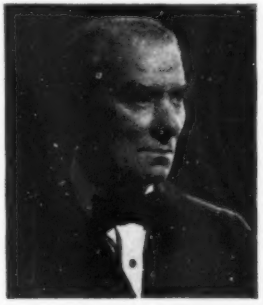
Company News

United Steel Companies

DIRECTORS' COMMENT ON PRICE INCREASE

SALES for the 24 weeks to March 18, 1961, of the United Steel Companies, Limited, increased to £68,925,000 from the £63,155,000 for the corresponding period of the previous year. Trading profit, however, declined to £9,250,000 (£10,479,000). Sales for the full year to September 30, 1960, were £139,569,000 and the trading profit £22,922,000. The directors announce a maintained 6 per cent. interim together with a one-for-four scrip issue proposal.

At the annual meeting in January the chairman, Sir Walter Benton Jones, stated that the current year's results before tax, might show a reduction of 10 per cent. to 15 per cent. because of substantial increases in costs of wages and materials, particularly fuel.



SIR WALTER BENTON JONES

It is now clear, holders are told, that the reduction will be larger as further heavy increases in cost have been suffered and the belated increase of 1 per cent. in steel prices covers only a small part of the cost increases which have accumulated since last summer. The directors feel that it is unfortunate that a more realistic attitude has not been adopted by the Iron and Steel Board.

It is still intended to recommend a final dividend for the year ending September 30, 1961, of not less than 7½ per cent. on the enlarged ordinary capital, including the scrip issue now proposed. The issue, involving capitalization of £10,000,000 from general revenue reserve, is for holders registered on June 21. An extra-ordinary general meeting is being called for July 19 to approve an increase in authorized capital to £75,000,000 and the proposed capitalization.

DANIEL DONCASTER & SONS, LIMITED, dropforgers, of Sheffield—Net profit fell from £408,632 to £437,766, after tax of £357,665 (£367,827). The dividend is maintained at 22½ per cent. with a final of 15 per cent.

HENRY HOPE & SONS, LIMITED, makers of metal windows, etc., of Smethwick—The dividend is being raised to 15 (12½) per cent. for the year to April 1, 1961. Group trading profit dropped slightly to £769,852 (£776,420).

AITON & COMPANY, LIMITED, ironfounders and pipework specialists, of Derby—Trading profit for the year to March 31, 1961, fell to £365,594 (£535,594), but dividend is being maintained at 12 per cent. with an 8 per cent. final, as forecast.

BRITISH ELECTRIC TRACTION COMPANY, LIMITED—Net profit is up to £4,182,619 (£3,584,711), after tax of £2,618,325 (£2,252,183) and the dividend for the year to March 31, 1961, is raised to 50 (40) per cent. with a final of 37½ per cent.

SCOTTISH MACHINE TOOL CORPORATION, LIMITED, Glasgow—Final dividend for the year ended March 31, 1961, is 10 per cent. (same), but payment for the year is increased to 15 (13) per cent. Net profits fell to £49,720 (£73,171), after tax of £52,000 (£67,000).

ANDERSTON FOUNDRY COMPANY, LIMITED, railway engineers and ironfounders, of Middlesbrough—Following a net loss of £54,265 (£79,149) for the year to March 31, 1961, no dividend has been declared, but a capital distribution of 3d. per 5s. share has been made.

DOVER ENGINEERING WORKS, LIMITED, engineers and ironfounders, etc., of Dover (Kent)—Total distribution for the year ended March 31, 1961, is being raised to 15 (12½) per cent. with a final dividend of 10 per cent. Net profit rose to £42,087 (£38,231) after tax of £43,769 (£36,629).

PULSOMETER ENGINEERING COMPANY, LIMITED—Offers by Booker Bros. McConnell & Company, Limited and G. & J. Weir Holdings, Limited, to acquire all the issued capital of Pulsometer Engineering has been accepted by holders of 80 per cent. of the nominal amount and has now been declared unconditional.

CASTINGS, LIMITED, malleable and general ironfounders, of Walsall (Staffs)—Against a forecast of 7½ per cent. the company is paying a final dividend of 10 per cent. making a total of 17½ (15) per cent. for the year to March 31, 1961. Net profit rose to £141,611 (£118,245), after tax of £79,611 (£58,612).

MINERALS SEPARATION, LIMITED—In the four years to December 31, 1960, group capital and reserves have grown from £2,662,495 to £5,341,510. If market values were substituted for balance-sheet figures, says Mr. J. N. Buchanan, the chairman, the comparable four-year figures would be £3,166,000 and £9,731,000.

SAUNDERS VALVE COMPANY, LIMITED—Group profits increased to £497,565 (£351,632) for the year ended March 31, 1961, and the dividend is effectively raised by 4½ per cent. A maintained final of 12½ per cent. on capital enlarged by the January one-for-two scrip issue makes a total equivalent to 17½ (13½) per cent.

CHARRINGTON, GARDNER, LOCKET & COMPANY, LIMITED, coal, coke and fuel oil distributors, of London, E.C.3—Final dividend of 8 (7) per cent. makes 12 (11) per cent. for the year ended March 31, 1961, on capital increased by a one-for-four rights issue. Net profit increased to £363,323 (£216,841) after tax of £331,854 (£236,105).

JOHNSON MATTHEY & COMPANY, LIMITED, refiners and metals manufacturers, of London, E.C.1—The dividend on the £6,000,000 ordinary capital is being

raised by 3 per cent. to 15 per cent. with a final of 12 per cent. for the year to March 31, 1961. Group profits expanded to £1,368,890 (£960,130), after UK tax of £1,356,513 (£965,169).

F. PERKINS, LIMITED, manufacturers of diesel engines, of Peterborough (Northants)—Directors of the company, which is a subsidiary of Massey-Ferguson Holdings, Limited, propose to increase issued capital by capitalizing £1,400,000 of undivided profits and paying up in full 1,400,000 ordinary shares of £1 each to existing shareholders or as they may direct.

TILLEY LAMP COMPANY, LIMITED—The financial year is to be extended to June 30 this year so that the present accounts will cover a period of 15 months from April 1, 1960. Thereafter, accounts will be made up to June 30 annually. This alteration has been made in view of the company's decision to transfer its production to a new factory in Northern Ireland.

ALLIED IRONFOUNDERS, LIMITED—Despite an increase in group sales, excluding those of the new subsidiaries, trading profit declined to £2,764,800 (£2,946,532) for the year to April 1, 1961, due mainly to narrower margins arising from increased costs. The dividend is held at 20 per cent. on capital increased by the acquisition of Bilston Foundries, Limited, with an unchanged final of 12½ per cent.

GREENWOOD & BATLEY, LIMITED, electrical and mechanical engineers, ironfounders, tool makers, etc., of Leeds—Final dividend of 10 per cent. makes 15 per cent. for the year to March 31, 1961, the same equivalent as paid for 1959-60, adjusting for a 100 per cent. capitalization. Group net profit fell to £78,701 (£125,249) after tax of £62,831 (£100,826) and after crediting £7,492 (£113) tax over-provision.

WOLVERHAMPTON METAL COMPANY, LIMITED, manufacturers of gun metal, phosphor bronze, and yellow metal ingots, etc., of Wednesfield—With a final dividend of 17½ per cent., total distribution for the year to March 31, 1961, is 27½ per cent. and, in addition, there is a bonus of 5 per cent., both the same as for the previous year. Group profit for the year is lower at £183,000 (£249,000) after tax of £182,000 (£201,000).

MATHER & PLATT, LIMITED, general engineers, of Manchester—The company has purchased the entire share capital of Henderson Engineering Company, Limited, of Glasgow. It is understood that the Henderson Company will continue under its own name for some time and will continue to manufacture its own products. Chairman of Mather & Platt, Mr. William L. Mather, and Mr. J. Douglas Paybody, will join the board of the Glasgow firm.

ARNOTT & HARRISON, LIMITED, engineers and tool makers, of London, N.W.10—The rights issue of preference shares is to be £1,000,000 17½ per cent. redeemable convertible 4s. shares at a price of 10s., raising some £500,000 of new capital. The shares are to be offered to ordinary holders at the rate of three for every eight 4s. ordinary held on July 12, immediately before the proposed one-for-two scrip issue of 1,322,650 ordinary is made.

WM. NEILL & SON (ST. HELENS), LIMITED, tank and industrial plant engineers—Net profit for the year to March 31, 1961, fell to £105,312 (£178,983), after tax of £104,000 (£161,000) and dividend is reduced by 4d. to 7d. per 2s. share. Throughout all departments prices have been extremely competitive, the board reports. Production has been well maintained at the main works, but at branch works production has been low and at margins too slender to meet costs.

AVERYS, LIMITED—Group profit before tax for the year to March 31, 1961, was £2,860,723 (£2,816,604) but, after allowing for 3 per cent. more tax than last year, net profit was lower at £1,373,480 (£1,446,909). Most companies in the group, says the chairman, Mr. W. L. Burrows, have larger order-books than a year ago, but shortage of suitable labour is likely to limit output and sales, and all the increasing costs of labour and materials cannot be reflected in increased prices.

TEMPERED GROUP, LIMITED, manufacturers of springs, agricultural implement accessories, engineering tools, etc., of Sheffield—Financial interest has been acquired in a Spanish spring-making company, Muré, SA, of Bilbao. The UK company is joining two Spanish companies, Echevarria, SA, one of Spain's biggest steel producers, and Placencia, SA to covert Muré to the manufacture of coil and leaf springs for the motor industry and railways. The Tempered Group is to design all the production equipment for Muré and directly supply part of it. Mr. Gerald Young, chairman of the Tempered Group, will be one of the British members of the board of Muré.

CASTROL, LIMITED—Contracts have been entered into for the acquisition of 75 per cent. of the share capital of Melwood Thermoplastics, Limited, Harpenden (Herts), and the entire share capital of Tensile Products, Limited, Harpenden (Herts). Mr. A. W. Meldrum will retain a financial interest in Melwood Thermoplastics and will continue as managing director of that company and of Tensile Products. Mr. A. G. T. Fryer and Mr. A. E. Chambers will remain on the board of Melwood Thermoplastics.

EASTWOODS, LIMITED—The strong demand for bricks, cement and other building materials made by the group continued at a high level throughout the year to March 31, 1961, and total sales turnover was a record, it is stated. Preliminary estimates indicate that group profits, before taxation, for the period will be about £1,200,000 (£1,000,715). An interim dividend of 7½ per cent. has been declared on the £2,000,000 ordinary stock, and subject to unforeseen circumstances, the directors expect to recommend a final dividend of 12½ per cent. to make a total for the year of 20 (17½) per cent.

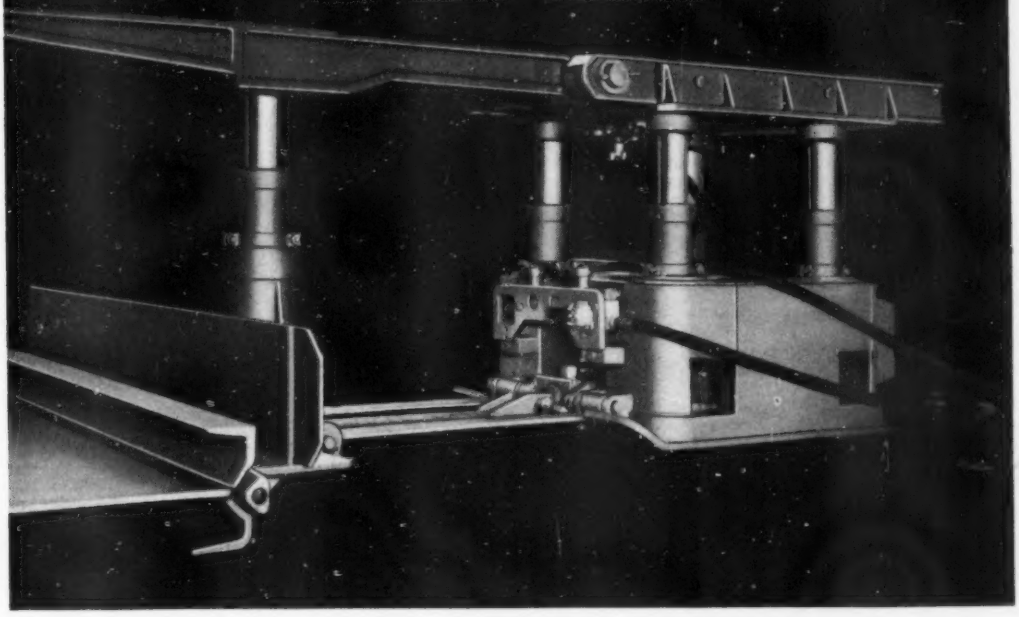
LAPORTE INDUSTRIES, LIMITED—The need to raise additional finance in the future, possibly within the next 18 months, is emphasized by Mr. P. D. O'Brien, the chairman, in his annual report. Heavy capital expenditure lies before the group and the balance sheet at March 31 last shows outstanding contracts placed totalling about £2,142,000 against £560,000 previously. There is, too, a commitment by the parent company for about £3,250,000 to erect a titanium oxide plant in Western Australia, to be completed not later than December, 1964. Another commitment, at Warrington, is over £1,000,000. Since the end of the financial year, Laporte has acquired Elektrochemische Werke München.

£3,000,000 Mining Equipment Order from Costa Rica

ORDERS valued at about £3,000,000 will shortly be placed in the UK for mining equipment for use in Costa Rica, where a $100,000,000 reduction plant to process iron ore is to be constructed on the Pacific coast. Iron-ore deposits in the Nicoya Peninsular were disovered in 1960 by International Iron of Costa Rica.

Mr. A. W. Dugan, founder of the company, will visit the UK in the next month for conferences and negotiations. The plant has a production target of 3,000,000 tons annually of iron luppen (similar to pig-iron).

THE GULLICK "SEAMAN" POWER ADVANCED SUPPORT for Low Seams



the 5-leg Chock developed from experience has 5 strong points

1. Strong Waste Edge Support to give good caving; maintains two rows of support between the Waste Edge and the Operator, and prevents waste flushing.
2. Front leg, designed to be as close to the face as possible and providing the forward support required, yet causing the least hindrance to the power loader operator.
3. Maximum travelling track provided by good design of roof bar, and Ram arrangement. With this Chock travelling is as good as conventional faces using props and link bars.
4. Hinged roof bar and three rows of props in the chock ensure the maximum distribution of load to the roof, throughout the whole width of the face.
5. Safe hydraulic fluid (water/soluble oil) together with the other features combine to ensure good roof control and the safest power advanced support yet advised.

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G31

NEWS IN BRIEF

BRITISH TITAN PRODUCTS, LIMITED, is planning additions to its plant at Billingham-on-Tees (Co. Durham).

COPY OF ITS SOUND FILM, "Firth-Brown Forged Steel Rollers," has been presented by Thos. Firth & John Brown, Limited, Sheffield, to Sheffield Corporation for the city archives.

AT THE ANNUAL CONFERENCE of the Confederation of Shipbuilding and Engineering Unions this week, it was decided unanimously to press immediately for higher pay for 3,250,000 manual workers in the two industries.

LONDON OFFICE of Crofts (Engineers), Limited, iron, steel and brassfounders, etc., of Bradford, is to move on Monday from 34, Norfolk Street, London, W.C.2, to new premises at 36/42 Tanner Street, London, S.E.1 (telephone: HOP 7751/4).

FIRM CONTRACTS were signed for 75 per cent. of the £250,000 worth of exhibits shown by the 19 members of the Scientific Instrument Manufacturers' Association of Great Britain at the British Industries Fair at Moscow. Preliminary contracts for further equipment for export have also been placed.

AT THE TWO-DAY seminar organized by the Cardiff and District Productivity Association last week in Cardiff, 30 work-study officers, works managers, engineering designers, and draughtsmen from South Wales, were introduced to the new science of "ergonomics"—the problem of fitting the job to the worker.

STEEL GIRDERS, some 99 ft. long, manufactured by the Tees Side Bridge & Engineering Works, Limited, for the construction of a new road bridge at Nottingham, were despatched last week by rail. The train carrying the girders was about 440 yd. long and was one of the largest of its kind to leave Tees-side.

NEW IRON-ORE concentrating mill, built at a cost of £500,000 by the Sierra Leone Development Company, Limited, was recently put into operation at Marampa, and is expected to step up production at the mines from 1,500,000 to 2,000,000 tons of iron ore per year. Plans have been laid for a further mill to be completed by 1964.

PRODUCTION OF raw steel in the US during the week ended June 19 was 1,985,000 net tons. This was 2.8 per cent. less than the 2,042,000 tons in the preceding week. Raw steel production in the US to date this year totalled 41,168,000 tons, a 27.9 per cent. decrease compared with the 57,137,000 tons produced in the corresponding period last year.

FOR THE THIRD year in succession, under an exchange scheme between the Consett Iron Company, Limited, and a firm near Dusseldorf, four German youths will come to work in Consett and four young employees at the Co. Durham firm will go to Germany. During the visits, which last six weeks, they will do each other's jobs and stay in each other's homes.

AUTOMATIC WEAVING looms of the type for which Russia has placed a £250,000 order, were seen by Mr. Niall Macpherson, Parliamentary Secretary, Board of Trade, when he visited the works of the Gresley Machine Company, Limited, Sunderland, last week. "Skilled engineers are coming to the north-east area," he said, "they are not all based in the Midlands."

ATTENDANCE AT THE annual dinner and dance of the South Staffordshire, Warwickshire, Worcestershire, and Shropshire branch of the National Association of Colliery Managers, at Sutton Coldfield, recently, under the chairmanship of the president, Mr. J. Every, was a record. Among the guests were Mr. J. G. Belfit, president of the South Staffordshire and Warwickshire Institute of Mining Engineers, Mr. F. S. Pollard, HM Divisional Inspector of Mines, Mr. T. S. Charlton, deputy chairman, West Midlands Divisional Coal Board, and Mr. H. Deakin, president of the Warwickshire branch of the Association of Mining Mechanical and Electrical Engineers.

EQUIPMENT WORTH £6,000 is being provided by Guest, Keen & Nettlefolds, Limited, Smethwick (Staffs), for Smethwick borough's Chance Technical College, in appreciation of its work for industry. The equipment, which will be on loan for three years, is half of that required for a new advanced machine tools laboratory. About 200 Guest, Keen & Nettlefolds students yearly attend the college.

FOLLOWING THE favourable reception of the Norton Dense Medium System at the Coal Show in Cleveland, Ohio, US, Nortons-Tividale, Limited, colliery engineers, etc., of Tipton (Staffs), has opened an office in Chicago, Illinois, US. Mr. Clifton Griggs, a well-known figure in the US coal-mining industry, has been appointed to manage the company's interests in America.

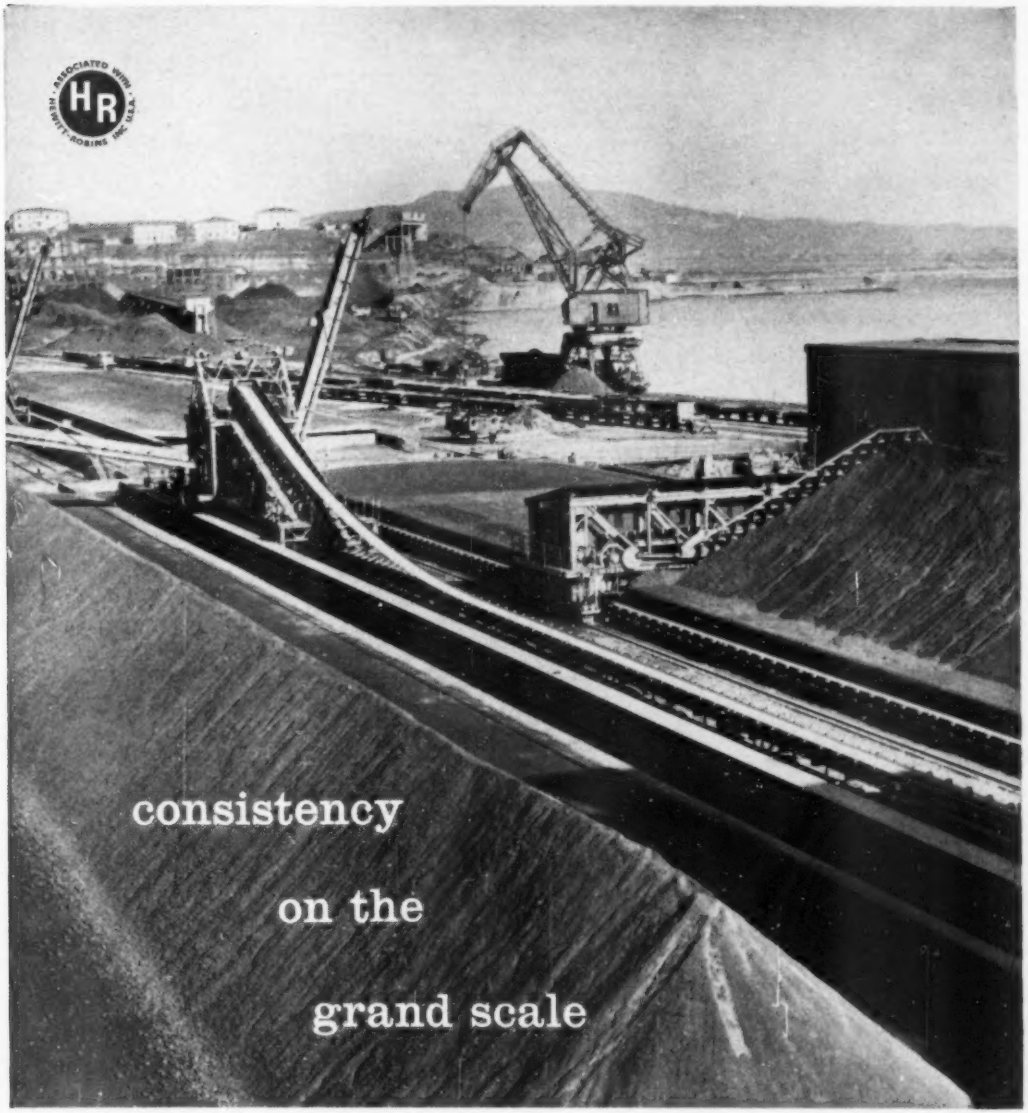
THE FOLLOWING works of British Insulated Callender's Cables, Limited, will be closed for two weeks for the receipt of goods during the stated periods:—Prescot, Helsby, Huyton Quarry, and Melling works, July 28-August 12; Erith works, July 22-August 7; Anchor works, Leigh, July 1-8 and September 9-16; Willenhall Foundry, Willenhall (Staffs), July 29-August 12. The dates are inclusive.

THERE WAS SOME remarkable scoring in the South Staffordshire branch of the National Association of Colliery Managers' golf meeting at Tamworth on Tuesday. Mr. Leslie Smith, the winner, and Mr. R. A. Barber both returned scores of 66 (net). Mr. H. Deakin, a guest, returned a score of 64. The Fenn Bowl was won by Mr. Smith on his performance of the last nine holes of the competition.

FURTHER INCREASE in prices, both of material used by industry and of finished products is reported by the Board of Trade. There was a small increase in the basic materials index by 0.3 per cent. to 97.7 (1954 =100). Fuel purchased by manufacturing industry cost less than in April, since higher prices for fuel oil reflecting the new duty, were more than offset by reduced summer prices of coal. The price level of all manufactured products also rose by 0.3 per cent. in May.

COST OF THE initial development of the project at Shewalton, near Irvine, Scotland, of the Skefko Ball-bearing Company, Limited, Luton, will be between £2,000,000 and £3,000,000 it was stated on Tuesday when the foundation stone of the new office block and administrative centre was laid by Sir Victor Mallet, chairman of the company. Mr. J. L. Dickinson, director and secretary of Skefco, said that it was expected that further factories would be built next year and in 1963 on the site.

RESULT OF THE golf match played recently at the annual meeting of Bowmaker (Plant), Limited, at Southerdown Golf Club (Glam) was:—1, E. Maxwell (Wilson Lovatt & Sons, Limited), and A. Benn (National Coal Board); 2, T. Girton (T. Jenkins & Company, Limited), and J. E. Brown (Bowmaker (Plant)); 3 (equal), W. J. Thomas (Glam. County Council), and T. E. Alker (Guest, Keen & Nettlefolds, Limited), and A. Y. Griffiths (Glam. River Board), and A. Perry (NCB).



Blast furnaces depend on it. Metallurgists count on it . . . Ores must be blended precisely, and fed with unvarying consistency to the blast furnace . . . That is the reason why Robins-Messiter blending plant was installed in Italy.

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CLASSIFIED ADVERTISEMENTS

PREPAID RATES: **Fifteen words for 7/6 (minimum charge) and 4d. per word thereafter. Box Number 2/6 extra per insertion (including postage of replies). Situations wanted 2d. per word throughout.**

Advertisements accompanied by a remittance and replies to Box Numbers should be addressed to the Advertisement Manager, Iron and Coal, John Adam House, 17/19, John Adam Street, London, W.C.2. If received by first post Tuesday, they can normally be accommodated in the next Friday's issue.

SITUATIONS VACANT

ASSISTANT MARKETING OFFICER

Applications are invited for the post of Assistant to the By-Products Marketing Officer at the National Coal Board's Durham Divisional Headquarters, which will shortly be moving from Newcastle to the Team Valley Trading Estate, Gateshead.

A knowledge of the various by-products produced from coal carbonisation is essential. The person appointed will be required to act in the absence of the Marketing Officer and he will be responsible for the movement of all products and the general supervision of clerical staff.

Salary will depend on qualifications and experience, on the scale £925 x £35—£1,200. Excellent Superannuation Scheme.

Apply within 7 days to D.C.S.O., N.C.B., Team Valley Trading Estate, Gateshead 11, Quoting SG/120/38(27).

MINING SURVEYORS wanted for colliery development contracts in central Scotland. Young men fully experienced in instrument work. Write for interview giving details to MOWLEM (SCOTLAND) LTD., 64 Frederick St., Edinburgh 2.

APPLICATIONS are invited for the appointment of ASSISTANT MECHANICAL ENGINEER at Gedling Colliery, Nottinghamshire.

Candidates should have served a recognised engineering apprenticeship and be qualified at the Ordinary National Certificate level (minimum).

The appointment is governed under the National Agreement for Weekly Paid Industrial Staff, is superannuable and housing accommodation can be available.

Write to:
AREA INDUSTRIAL RELATIONS OFFICER,
National Coal Board,
East Midlands Division,
No. 6 Area Headquarters,
BESTWOOD, Nottingham.

Closing date: 7th July, 1961.

MINING EQUIPMENT MANUFACTURERS with expansionist programme seek to appoint a

SALES MANAGER

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Applications, in strict confidence, should be addressed to MANAGING DIRECTOR, Box MG409, IRON AND COAL.

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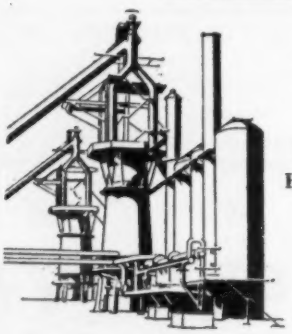

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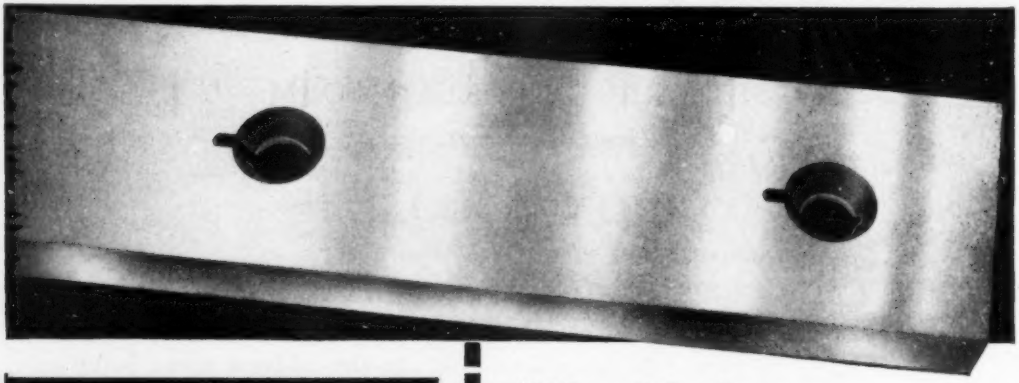

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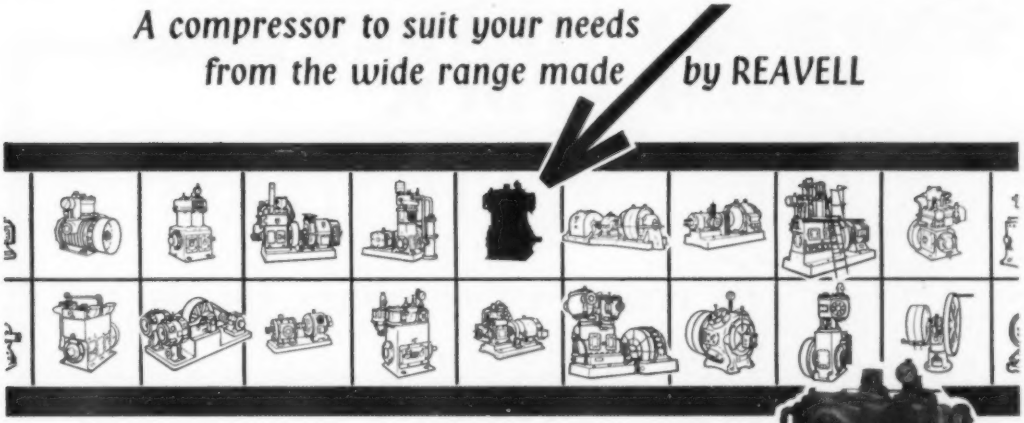

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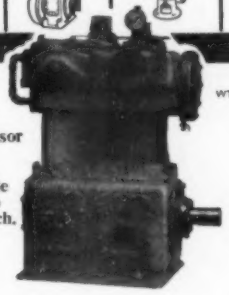

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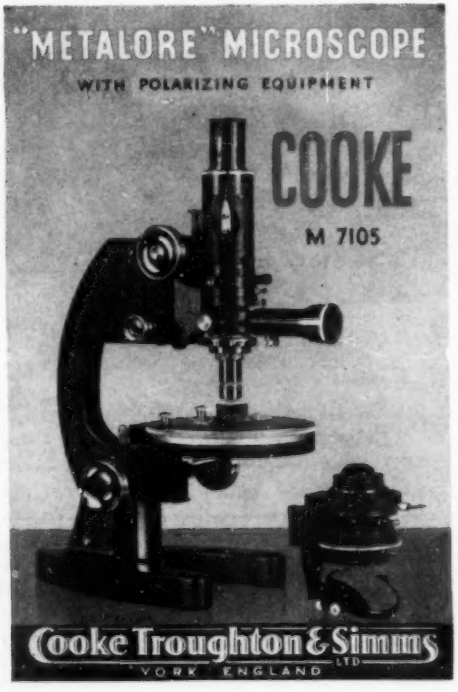

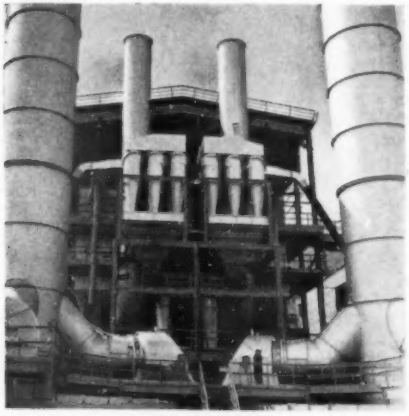

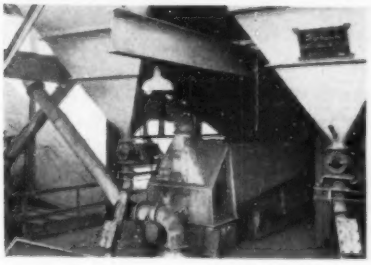

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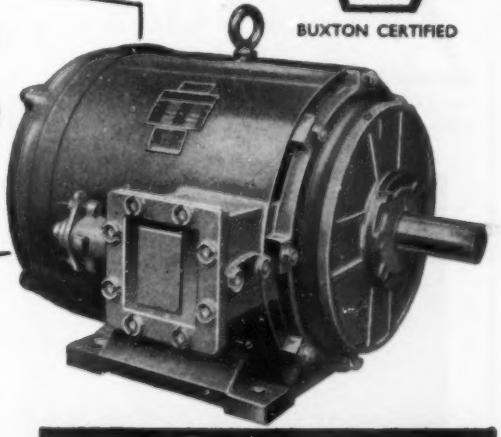

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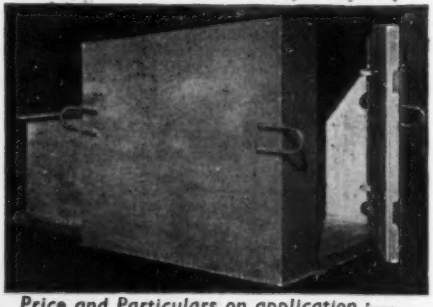

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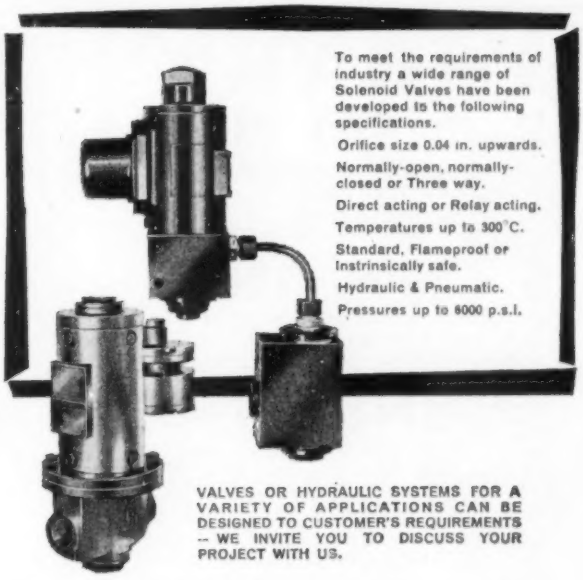

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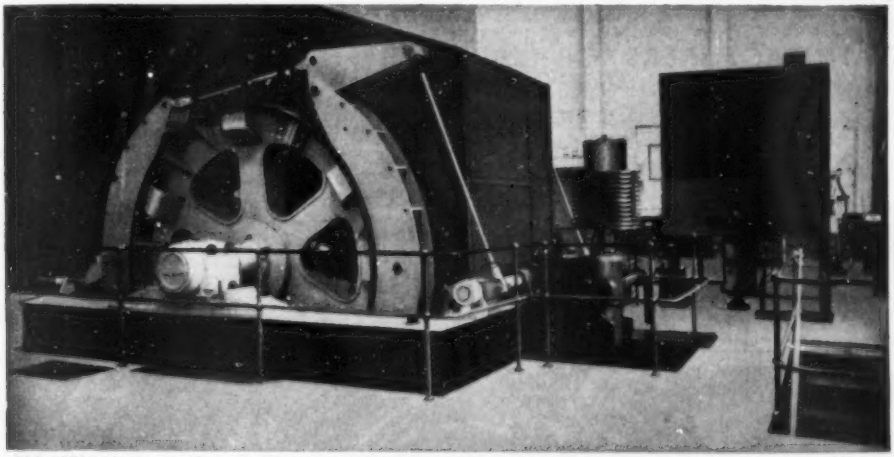

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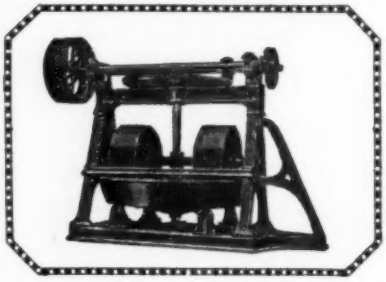

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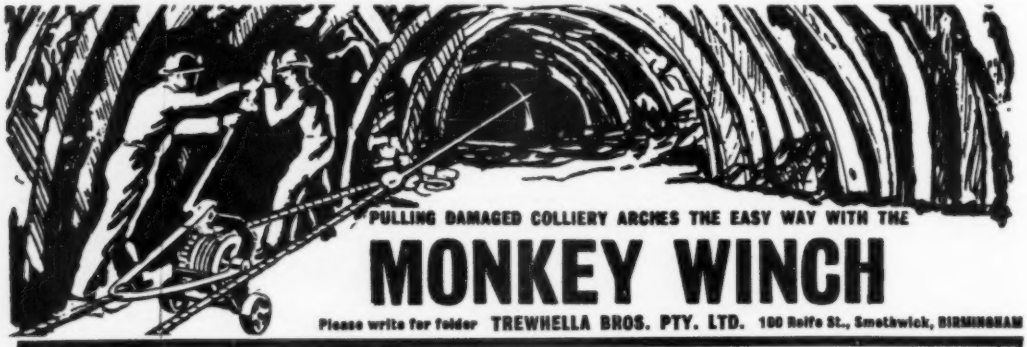

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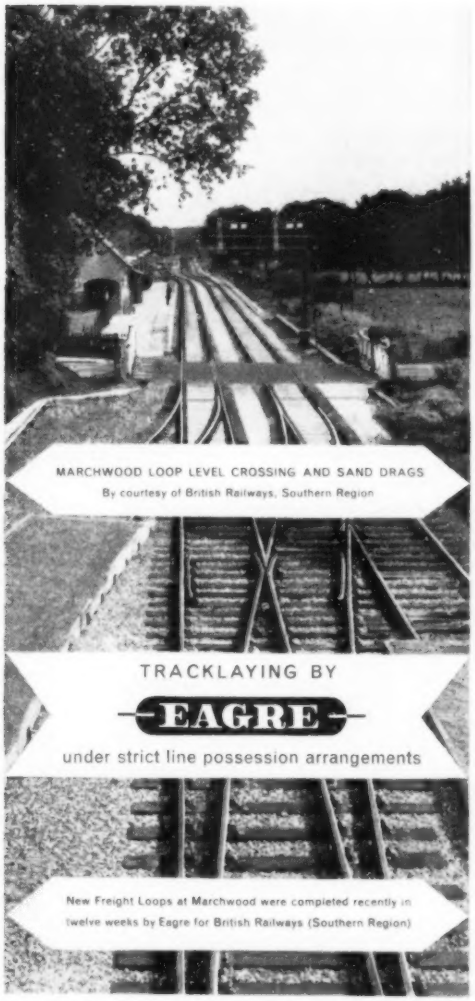

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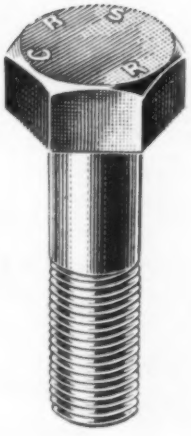

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INDEX TO ADVERTISERS—*continued from page 70.*

Jenkins, W. J. & Co. Ltd. .. 14
Johnson Rolls Ltd. .. .. —
Jones, W. Stanley (Engineers) Ltd. .. .. —
Joy, Sullivan Ltd. 29

Kennedy, Allan & Co. Ltd. .. —
Kenyon, Wm. & Sons Ltd. .. —

Lafarge Aluminous Cement Co. Ltd. .. .. .. —
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Lanarkshire Steel Co. Ltd. .. —
Lancaster & Tonge Ltd. .. —
Lane, Francis & J. S. Ltd. .. —
Ledward & Beckett Ltd. .. —
Lever, J. & Sons Ltd. .. 58
Lilleshall Co. Ltd. .. .. —
Lindley, H. Ltd. .. .. —
Locker Industries Ltd. .. 62
Lodge-Cottrell Ltd. .. .. —
Lumb, Jas. & Sons Ltd. .. —
Lysaght's Scunthorpe Works —

Mackley, E. N. & Co. Ltd. .. —
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"Monitor" Patent Safety Devices Ltd. .. .. —
Mono Pumps Ltd. 40
Moorwood, John M. Ltd. .. —
Morgan Refractories Ltd. .. —
Morris, Robert Ltd. 18
Mowlem-Centraline .. .. —
Murex Welding Processes Ltd. —
Muschamp, N. J. & Co. Ltd. —

National Boiler & General Insurance Co. Ltd. .. .. —
National Coal Board .. .. —
National Industrial Fuel Efficiency Service .. .. —
Neal, R. H. & Co. Ltd. .. 37
Needham Bros. & Brown Ltd. —
Nelson, W. & H. Ltd. .. —
New Conveyor Co. Ltd. .. —
Newell, Ernest & Co. Ltd. .. 17
Newton Chambers & Co. Ltd. .. .. —
Niagara Screens & Plant Ltd. —
Nife Batteries .. .. .. —
Nordberg Manufacturing Co. Ltd. .. .. —
North British Rubber Co. Ltd. —
North Eastern Marine Engineering Co. Ltd. .. .. —
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Norton, Sir James Farmer & Co. Ltd. .. .. .. —
Nortons Tividale Ltd. .. —

Oldham & Son Ltd. .. .. —
Ormerod, Edward & Co. Ltd. 24
Osborn, S. & Co. Ltd. .. —
Oughtibridge Silica Firebrick Co. Ltd. .. .. .. —

Padley & Venables Ltd. .. —
Parkes, Timothy, & Sons Ltd. —
Parramore, F. & Sons Ltd. .. —
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Patterson Lamps (1953) Ltd. —
Pegson Ltd. .. .. .. —
Permutit Co. Ltd. .. .. —
P.G. Engineering Ltd. .. —
Pickford, Holland & Co. Ltd. 15
Pittrail Ltd. .. .. .. —
Power-Gas Corporation Ltd. .. 2
Power Gas Economy Co. .. —
Power Plant Co. Ltd. .. —
Premier Cooler & Engineering Co. Ltd. .. .. .. —
Press, Wm. & Son Ld. .. 35
Price, J. T. & Co. Ltd. .. —
Priest Furnaces Ltd. .. 44
Procter Bros. (Wireworks) Ltd. —
Protector Lamp & Lighting Co. Ltd. .. .. .. —
Pulsometer Eng. Co. Ltd. .. 57

Qualter Hall & Co. Ltd. .. 11

Railway & General Engineering Co. Ltd. .. .. —
Raine & Co. Ltd. .. .. —
Ransomes & Marles Bearing Co. Ltd. .. .. .. —
Rapid Magnetic Ltd. .. .. —
Rawlplug Co. Ltd. .. .. —
Reavell & Co. Ltd. 59
Reay Brass Foundry Co. Ltd. —
Reid Gear Co. Ltd. .. .. —
Reliance Rope Attachment Co. Ltd. .. .. .. —
Renold Chains Ltd. .. .. —
Reside, Jas. Ltd. .. .. —
Revolvo Ltd. .. .. .. —
Reyrolle, A. & Co. Ltd. .. —
Rheolaveur General Construction Ltd. .. .. .. —
Rhodes, S. & Co. Ltd. .. 64
Rhymney Engineering Co. Ltd. —
Richards, Chas. & Sons Ltd. .. 67
Richards Structural Steel Co. Ltd. .. .. —
Richardsons Westgarth Atomic Ltd. .. .. —
Richardsons Westgarth (Hartlepool) Ltd. .. .. —
Rigley, Wm. & Sons Ltd. .. —
Robertson, W. H. A. & Co. Ltd. —
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Ruston & Hornsby Ld. .. —
Ruston-Bucyrus Ld. .. —

Sack, Maschinenfabrik, G.m.b.H. .. .. .. —
Salem-Brosius (England) Ld. —
Saunders Valve Co. Ld. .. 36
Sentinel (Shrewsbury) Ld. .. —
Shaw, W. & Co. Ld. .. .. —
Shell Mex & B.P. Ld. .. —
Sheen (Nottingham) Ld. .. —
Sheepbridge Equipment Ld. —
Sheffield Twist Drill & Steel Co. Ld. 13
Sheffield Wire Rope Co. Ld. —
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Silvertown Rubber Co. Ld. .. —
Simon-Carves Ld. .. .. —
Simon, Richard & Sons Ld. .. 4
Siskol Machines Ld. .. 42
Skefko Ball Bearing Co. Ld. —
Skinningrove Iron Co. Ld. .. —
Smallman, Jas W. Ld. .. —
Smedley Bros. Ld. 66
Smith & McLean Ld. .. 69
Smith, John (Keighley) Ld. .. —
Smith, Thos. & Son (Rodley) Ld. .. .. —
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Stanton Ironworks Co. Ld. .. —
Steam & Combustion Engineering Ld. .. .. —
Steel Co. of Wales Ld. .. 21
Steels Engineering Products Ld. .. .. —
Steelway Ld. .. .. .. —
Stein & Atkinson Ld. .. 71
Stein, J. G. & Co. Ld. .. —
Stephens Silica Brick Co. Ld. —
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Strachan & Henshaw Ld. .. —
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Sturdy Electric Co. Ld. .. 69
Summerson, Thos. & Sons Ld. —
Sutcliffe, Richard, Ld. .. 43
Sutcliffe, Speakman & Co. Ld. 20

Tattersall & Sons Ld. .. 58
Taylor, F. & Sons (Manchester) Ld. .. .. .. —
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Tungsten Carbide Developments Ld. .. .. .. —
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Unifloc Ld. 22
United Fireclay Products Ld. —
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United Steel Companies Ld. —
United Wire Works Ld. .. —
Uskside Engineering Co. Ld. 65

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Vaughan Crane Co. Ld. .. 61
Victor Products (Wallsend) Ld. .. .. —
Visco Engineering Co. Ld. .. —

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Wailes Dove Bitumastic Ld. 38
Walker Bros. (Wigan) Ld. .. —
Wallacetown Engineering Co., Ld. .. .. —
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Wellman Bibby Co. Ld. .. —
Wellman Smith Owen Engineering Corporation Ld. .. 41
West Bromwich Spring Co. Ld. —
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West's (Manchester) Ld. .. —
West's Piling & Construction Co. Ld. .. .. .. —
Westwood, Dawes & Co. Ld. —
Wharton Crane & Hoist Co. Ld. .. .. —
Whipp & Bourne Ld. .. 26
White, R. & Sons (Engrs.) Ld. —
Whittaker, C. & Co. Ld. .. 58
Wickman Ld. .. .. .. —
Widnes Foundry & Engineering Co. Ld. .. .. —
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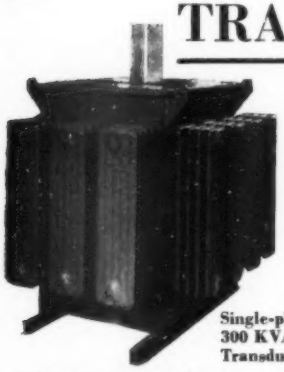

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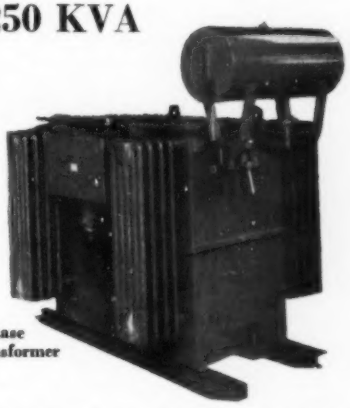

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Armstrong-Whitworth (Metal Industries) Ltd. 5
Armytage & Sons Ltd. .. —
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Barlow & Chidlaw Ld. .. —
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Barrow Ironworks Ltd. .. —
Bathgate, Richard A. .. —
Bayliss, Jones & Bayliss Ltd. 16
Beckett & Anderson Ld. .. 61
Becorit (G.B.) Ltd. .. .. —
Beldam Asbestos Co. Ltd. .. —
Belliss & Morcom Ld. .. —
Belmos Co. Ltd. .. .. —
Beresford, Jas. & Son Ld. .. —
Birkett, Billington & Newton Ltd. .. .. .. —
Birlec-Efco (Melting) Ld .. 50
Birtley Engineering Ltd. .. —
Blacks Mining Equipment .. —
Blandford-Gee Cementation Co. Ltd. .. .. —
Blantyre Engineering Co. Ltd. —
Bolton Gate Co. Ltd. .. —
Bonser Tristram Ld. .. 6
Boyles Bros. Drilling Co. Ltd. —
Bradley, J. & Co. (Stourbridge) Ld. .. .. .. —
Bradley Pulveriser Co. Ltd. .. —
B.R.D. Co. Ltd. .. .. —
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British Jeffrey-Diamond Ld. —
British Nylon Spinners Ld. .. —
British Oxygen Co. Ld. .. —
British Paints Ld. .. .. —
British Resistor Co. Ld. .. 47
British Rollmakers Corporation Ld. .. .. —
British Ropeway Engineering Co. Ld. .. .. —
British Steam Specialties Ld. —
British Timken: Division of the Timken Roller Bearing Co. .. .. —
Broadbent, Thos. & Sons Ld. 25
Brown, David Corporation (Sales) Ld. .. .. —
Brush Electrical Engineering Co. Ld. .. .. —
Brymbo Steel Works Ld. .. 7
B.T.R. Industries Ld. .. 39
Buell Ld. 63
Burnand, W. E. & Son Ld. .. —
Burnside, George Ld. .. —
Burtonwood Engg. Co. Ld. .. —
Bushing Co. Ld. .. .. —

Cable Belt Ld. .. .. —
Calomax (Engineers) Ld. .. —
Carblox Ld. .. .. .. —
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Ceag Ld. .. .. .. —
Chloride Batteries Ld. .. —
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Clayton Equipment Co. Ld. .. —
Cleveland Bridge & Engineering Co. Ld. .. .. —
Cohen Bros. (Electrical) Ld. —
Cohen Geo. Sons & Co. Ld. .. 72
Colvilles Ld. .. .. .. —
Conflow Ld. .. .. .. —
Consett Iron Co. Ld. .. —
Consolidated Pneumatic Tool Co. Ld. .. .. .. —
Cooke, Troughton & Simms Ld. 62
Cooper, Jas. Milne & Co. Ld. 66
Cooper Roller Bearings Co. Ld. —
Coppee Co. (Gt. Britain) Ld. 9
Cotterill, Herbert Ld. .. 62
Coulson, M. & Co. Ld. .. —
Courtaulds Ld. .. .. —
Cowlishaw, Walker & Co. Ld. 49
Cox & Danks Ld. .. .. —
Crawley Industrial Products Ld. .. .. .. 32 & 33
Cripps, R. & Co. Ld. .. 34
Croda Ld. .. .. .. —
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Crompton Parkinson Ld. .. —
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Curtis, A. L. (Onx) Ld. .. —

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Dobson, W. E. & F. Ld. .. 30
Dollery & Palmer Ld. .. 10
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Dorman Long & Co. Ld. .. —
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Dowty Mining Equipment Ld. —
Dunlop Rubber Co. Ld. .. —

Eagre Construction Co. Ld. .. 67
Edge & Sons Ld. .. .. —
Eickoff, Gebr. 31
Eimco (Gt. Britain) Ld. .. —
Elastic Rail Spike Co. Ld. .. —
Elcordia Ld. 64
Electrical Development Association .. .. —
Electric Furnace Co. Ld. .. —
Electro-Hydraulics Ld. .. 65
Ellis, A. & Sons (Wakefield) Ld. .. .. .. —
Engineering, Marine, Welding & Nuclear Energy Exhibition .. .. .. —
English Drilling Equipment Co. Ld. 40
English Electric Co. Ld. .. —
English Steel Corporation Ld. —
Evans, Joseph & Sons (Wolverhampton) Ld. .. .. —
Ewart Chainbelt Co. Ld. .. 57

Fearnehough, W. Ld. .. 58
Felco Hoists Ld. .. .. —
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Fielding & Platt Ld. .. —
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Forster, T. S. & Sons Ld. .. —
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Foster, Henry & Co. Ld. .. —
Foundry Services Ld. .. —
Fowler, John & Co. (Leeds) Ld. 8
Fuel & Metallurgical Processes Ld. .. .. —
Fullerton, Hodgart & Barclay Ld. .. .. .. —

Gas Council .. .. .. —
General Electric Co. Ld. .. 55
General Refractories Ld. .. —
Gent & Co. Ld. .. .. —
Gibbons Bros. Ld. .. .. —
Gibbons (Dudley) Ld. .. —
Glover Bros. (Mossley) Ld. .. —
Glover, Wm. Jas. & Co. Ld. .. 19
Goodall, Clayton & Co. Ld. .. —
Goodyear Tyre & Rubber Co. Ld. .. .. .. —
Green, E. & Sons Ld. .. —
Green, Horace & Co. Ld. .. 63
Greening, N. & Sons Ld. .. —
Guest, Keen Iron & Steel Works 46
Gullick Ld. 53
Gutehoffnungshutte Sterkrade 10

Hackbridge & Hewittic Electric Co. Ld. .. .. —
Hadfields Ld. .. .. —
Halcsowen Steel Co. Ld. .. —
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Hallamshire Steel Co. Ld. .. —
Hanmade Conveyor Co. Ld. .. 45
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Hill, Richard Ld. 23
Hills (West Bromwich) Ld. .. —
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Holmes, W. C., & Co. Ld. .. —
Holroyd, John & Co. Ld. .. 48
Honeywell Controls Ld. .. —
Hopkinson, A. & Co. Ld. .. —
Hornsby & Goodwyn Ld. .. 64
Hoy, Austin & Co. Ld. .. —
Hudswell, Clarke & Co. Ld. .. —
Humber Graving Dock and Engineering Co. Ld. .. —
Hunslet Engine Co. Ld. .. —
Huntington, Heberlein & Co. Ld. .. .. .. —

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Incandescent Heat Co. Ld. .. —
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International Harvester Co. of Great Britain Ld. .. —
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(*Continued on page 68*)

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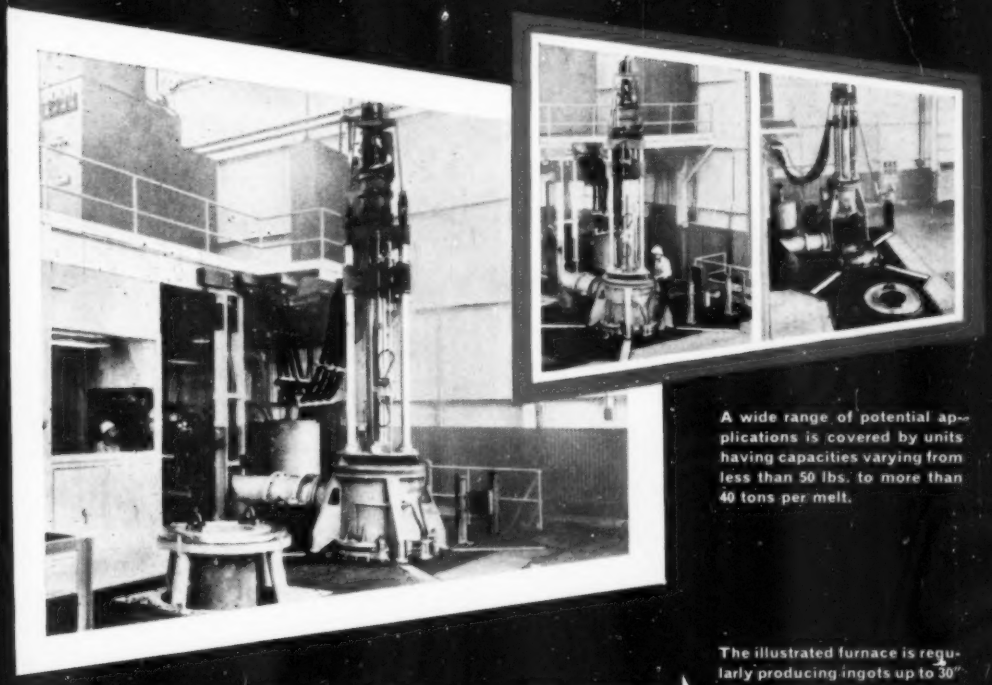

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